Electrical World

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Editor

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Commission Control Over Electricity Crossing State Lines Illegal

THE decision of the Supreme Court in the Narragansett-Attleboro case establishes definitely that electrical energy generated in one state and sold in another constitutes interstate commerce and hence the rate for such service is not subject to regulation by the state public service commissions. If regulation is required, the court holds, "it can only be obtained by the exercise of the power vested in Congress." This is but a reiteration of the principle laid down by the court in the Missouri vs. Kansas Gas case, and inasmuch as Congress has not given regulatory power over gas and electricity to any commission, national or state, such interstate business is at present free from legal regulatory restraints.

However, good public policy suggests that electric public utility corporations voluntarily submit what little interstate business they do to joint state commission supervision until such time as Congress shall act. Obviously, no congressional action can possibly be forthcoming until 1928, if then. Meanwhile, however, the various state commissions should devise some suitable form of legislation by means of which Congress might delegate to the state commissions, acting jointly, regulatory powers over interstate electric and gas business. The present desire of electric public utility companies is to conduct all their business under state supervision. National supervision is too remote from the field of action to be satisfactory to the public, and what is inimical to local public interest is likewise undesirable to electric public utility companies. Prompt action is necessary in either case, however, for the electric public utility business, being logically subject to state commission supervision, ought not to continue long with part of its business unregulated.

An Opportunity to Modernize and to Organize

EXPENDING a billion dollars a year for new facilities and doing a gross business of a billion and a half dollars a year, the electrical industry provides sufficient opportunity for saving time and money to warrant executives in giving more attention to sound principles of organization and to the adoption of modern equipment and methods in accounting, storekeeping, billing and numerous other activities. A large majority of public utilities still write longhand bills for all customer accounts and use ponderous tomes for delectation of bookkeepers. No two utilities have the same type of organization for doing business or use identical methods. Few utility leaders can talk about their business in terms of the accurate cost accounting used by manufacturing executives.

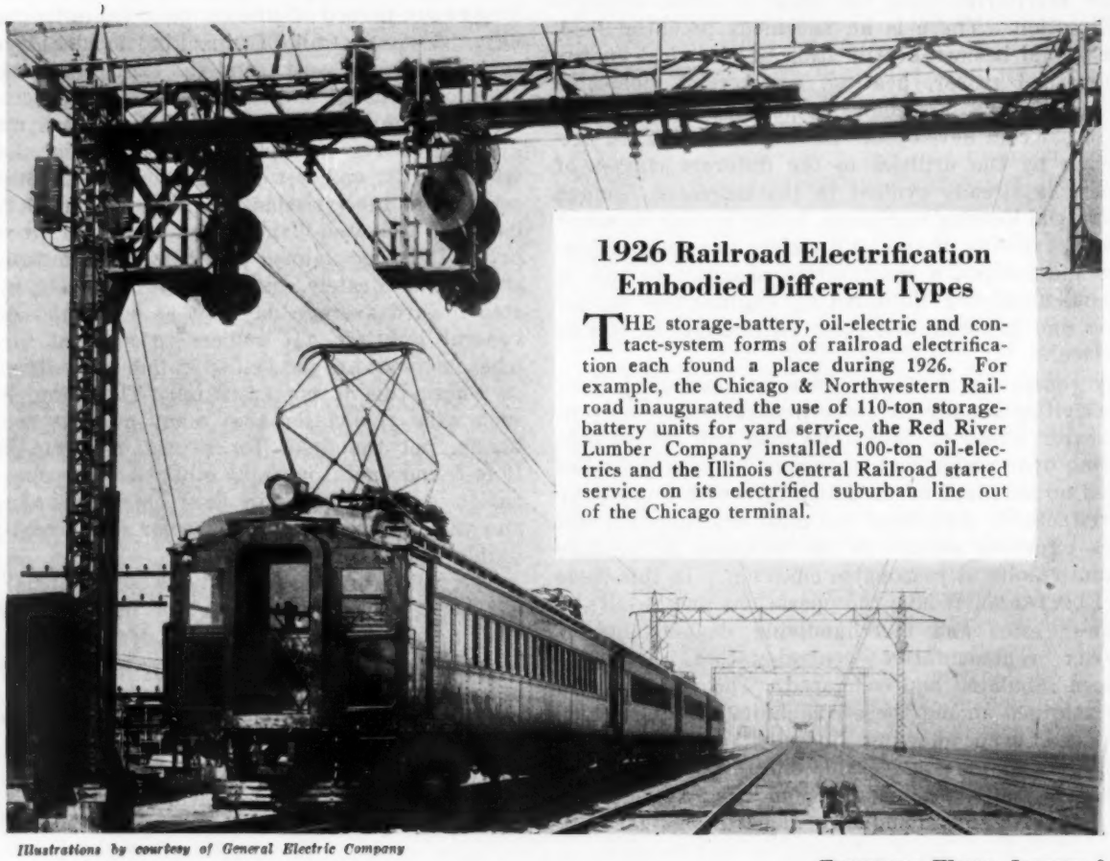
Excuses in plenty can be found for existing conditions. These may be summed up in the brief statement that the pressure of a very rapidly expanding industry with limited man power was too great to permit any different solution of the problems encountered. But while the past may be forgiven and the future cannot be read, there is an opportunity and an obligation to modernize and to organize the industry. The savings will more than pay for the costs and the business will grow more intelligently. Engineering, commercial, operating, financial, billing and accounting departments can be better organized and can be equipped with modern facilities for doing a large business more economically and more rapidly. Those utility companies that have given study to these matters have benefited greatly.

Interchange Contracts Often Incompatible with Economical Operation

SOME executives are questioning whether they are gaining all of the benefits from interconnections of stations and systems which they anticipated. An operating engineer will immediately reply that operating contingencies, such as storms, failure of apparatus, construction work, faulty relay operation, inspection and maintenance work, and so forth, make the benefits of interconnection fall far short of the theoretical advantages and even of those which the designers themselves sometimes contemplate. More than this, operating a system for continuity of service often militates against economy and vice versa.

Possibly the reasons why all the contemplated benefits are not being realized would be seen if every executive and head of a design department would visit his load dispatcher's office during a storm or other disturbance and later inquire for the reasons back of the apparently snap decisions given. Those visitors who have been sufficiently inquisitive are usually first impressed with the complexity of the problems which have to be solved at once and then with the variety of knowledge which the load dispatcher has to have on tap for making decisions. Without any further complications than those previously suggested, a load dispatcher has to perform a real job, the execution of which determines the system economy and service reliability actually obtained. Other persons may have laid out a system which represents the most value for the dollar expended, or the components of which separately perform their functions most economically. But it is the system operator and those co-operating with him who must keep those invested dollars active and obtain the highest economy.

Consequently, if the greatest benefits are to be derived from interconnections, nothing should be done which will handicap or limit the load dispatcher, or system operator, in the performance of his duties. A



1926 Railroad Electrification Embodied Different Types

THE storage-battery, oil-electric and contact-system forms of railroad electrification each found a place during 1926. For example, the Chicago & Northwestern Railroad inaugurated the use of 110-ton storage-battery units for yard service, the Red River Lumber Company installed 100-ton oil-electrics and the Illinois Central Railroad started service on its electrified suburban line out of the Chicago terminal.

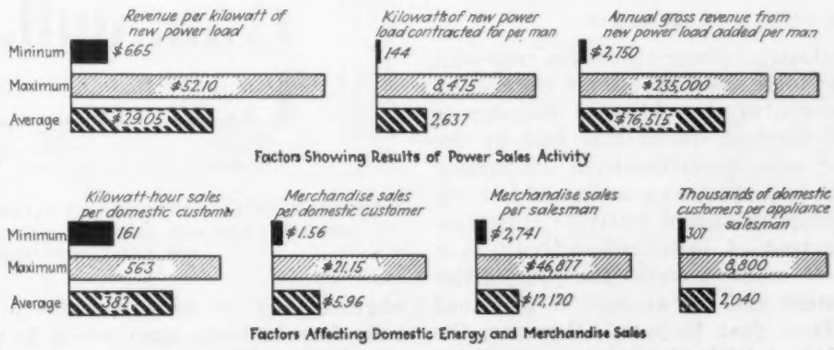
Illustrations by courtesy of General Electric Company

Measuring Commercial Proficiency

Analysis of Results of Load-Building Operations of 26 Central-Station Companies Shows Wide Range in Standards of New Business Accomplishment—Applying Yardstick of Efficiency to Power Sales and Merchandising

HOMES AS CLOSE AS THESE WITH 1 000 KW.-HR. PER CUSTOMER SHOULD CONSTITUTE ATTRACTIVE LOAD

AS ELECTRIC utilities direct more attention to increasing loads and revenues, the operations of new-business departments are more closely scrutinized and it has become extremely desirable to find some means of comparing the effectiveness of commercial efforts of one company with another. Obviously it is impracticable to set up any single element such as kilowatt-hour sales per meter, total connected load or gross revenue per inhabitant as a yardstick, because nature of territory served, type of system, rate and so on create too many variables. All of these, however, are factors in considering commercial efficiency and may be used in part as a gage or yardstick of what might be expected under certain conditions. To ascertain what influences different companies' load development and arrive at some common denominator for determining relative commercial proficiency the ELECTRICAL WORLD has obtained data showing the distribution of energy sales to different classes of customers, new power load added and merchandise sales from a number of electric utilities. Information sufficiently complete for comparative purposes has been tabulated for 26 companies. The companies selected range in size from less than 500 customers to nearly 500,000 customers and render service to a total of 1,195 different cities, towns and communities. The combined gross revenue of the 26 companies was almost exactly 10 per cent of the total income of all central stations in 1925, and the kilowatt-hour sales repre-



MAXIMUM, MINIMUM AND AVERAGE POWER, DOMESTIC ENERGY AND MERCHANDISE SALES

sented 13.3 per cent of the national total for the same year.

Environment naturally plays an important part in the proportional amount of energy sold to different classes of customers, and whether a community is essentially residential, commercial or industrial is at once reflected in a chart showing the distribution of energy sales. The accompanying diagram shows these characteristics graphically. In the smaller cities and towns having less than 5,000 electric service customers, domestic and commercial energy sales combined account for 54.6 per cent of the total. Industrial power sales are only 29.5 per cent, but in two instances the power load is 49 per cent and 62.5 per cent of these companies' total sales, which may be interpreted as an indication of the tendency on the part of industrial plants to establish new factories in the smaller cities in preference to the larger metropolitan areas.

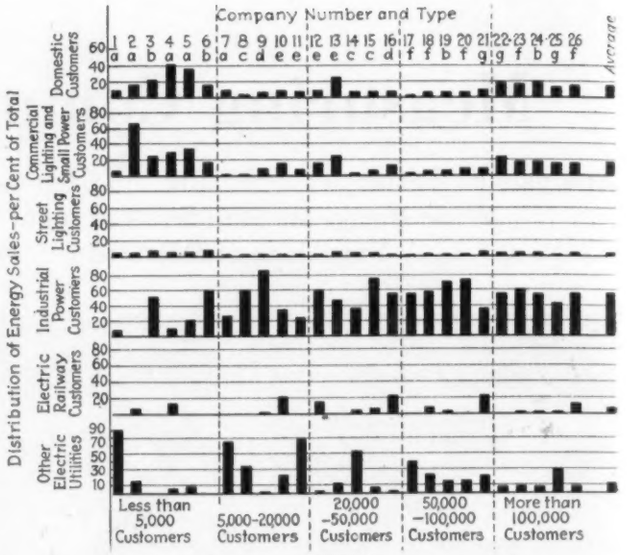
NATURE OF TERRITORIES SERVED

As the size of the system increases above 5,000 customers there is a marked decrease in the percentage of domestic and commercial energy sales until systems of more than 100,000 customers are reached, when sales to these classes of customers jump up again. The proportion of industrial power sales for all companies of more than 5,000 customers is fairly consistent, varying with the degree of local industrial activity. Street-lighting sales in no case amount to more than 5.6 per cent of the total and for a more considerable part are less than 2 per cent.

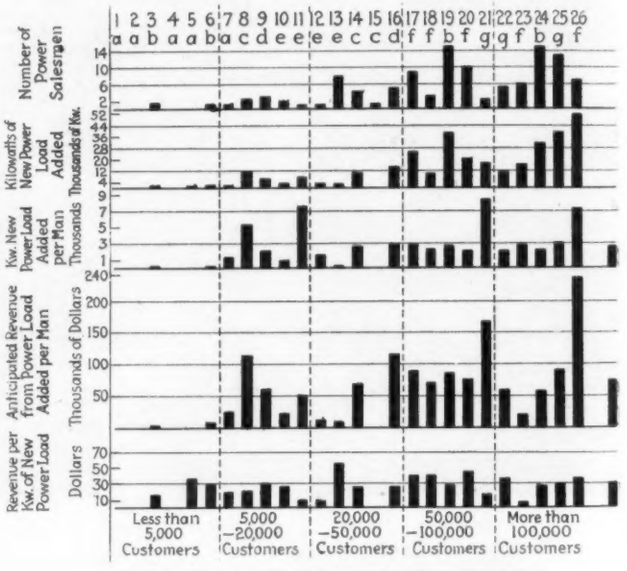
From a study of the distribution of energy sales to different classes of customers it would appear that the industrial power load is being actively developed by companies of all sizes, but that in companies having from 5,000 to 100,000 customers the domestic and commercial loads have not been given the degree of intensive cultivation found in systems both above and below these qualifications. Energy sales to electric railways and other utilities influence the ratios of sales by some companies, but the fact remains that the larger systems with fairly uniform percentages of power sales still show a consistently higher percentage of sales to domestic and commercial users. Charting the energy sales per domestic customer shows the same tendency—a decided drop in the curve for medium-sized companies with a marked upward swing for companies with 50,000 customers or more. On the face of these facts it is logical to conclude that as systems increase in size their commercial organizations become more efficient and that the advantages of centralized management and consolidation which have been realized in engineering and finance also hold true in commercial operations.

POWER SALES DEPARTMENTS

Energy sales to industrial power customers represent 54.8 per cent of the total sales by all the companies. As much of the growth of the electrical industry is the direct result of development of this load by the central-station power sales departments, a comparison of their operations is important as a means of judging how intensively a company should cultivate this class of business. The extent of industrial activity in a company's territory of course governs the possibilities of ultimate development and the amount of new load that can be added from year to year. However, the value of additional industrial load in revenue per kilowatt, connected load contracted for by each power sales

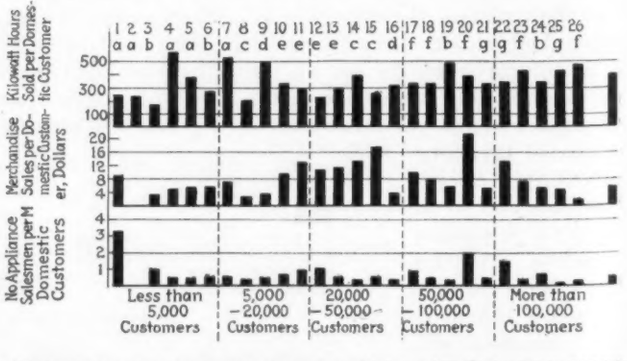


DISTRIBUTION OF ENERGY SALES VARIES WITH NATURE OF TERRITORY AND SIZE OF SYSTEM


Number of Power Salesmen
Kilowatts of New Power Load Added Thousands of Kw.
Kw. New Power Load Added per Man Thousands
Anticipated Revenue from Power Load Added per Man Thousands of Dollars
Revenue per Kw. of New Power Load Dollars
Less than 5,000 Customers
5,000 –20,000 Customers
20,000 –50,000 Customers
50,000 –100,000 Customers
More than 100,000 Customers

INDUSTRIAL POWER SALES FOR 26 SYSTEMS

New power load added depends upon industrial activity in territory and number of power sales engineers. The average power salesman contracts for 2,637 kw. of new load with an anticipated gross annual revenue of $76,515.


Kilowatt Hours Sold per Domestic Customer
Merchandise Sales per Domestic Customer, Dollars
No. Appliance Salesmen per M Domestic Customers
Less than 5,000 Customers
5,000 –20,000 Customers
20,000 –50,000 Customers
50,000 –100,000 Customers
More than 100,000 Customers

COMPARISON OF DOMESTIC ENERGY SALES, MERCHANDISE SALES PER CUSTOMER AND NUMBER OF APPLIANCE SALESMEN PER 1,000 CUSTOMERS

engineer and the added revenue per power sales engineer form a basis upon which to compare the results obtained by different companies.

In the accompanying diagram giving the number of

Table I—Comparison of Commercial Operations and Results of 26 Representative Central-Station Companies

Size of System	Company and Type of Territory	No. of Communities Served	Distribution of Energy Sales, Per Cent						Power Sales					Merchandise Sales					
			Domestic	Commercial	Street Lighting	Power	Railway	Other Utilities	No. of Men	New Power Load Added, Kw.	Annual Revenue per Kw.	Power Load Added per Man Kw.	Power Load Added per Man Revenue	No. of Salesmen	No. of Stores	Per Dom. Customer	Per Salesman	Dom. Consumer No. per Salesman	Dom. Consumer Sales per Kw.-Hr.
Less than 5,000 customers	1[1]	3	7.0	5.5	2.9	4.8	.....	79.8	.....	.....	.....	.....	.....	1	1	$8.95	$2,741	307	239
	2[1]	1	14.5	66.3	3.2	.....	3.8	12.2	.....	.....	.....	.....	.....	1	1	.....	.....	.....	228
	3[2]	1	20.7	24.7	5.6	49.0	.....	.....	1	188	$14.60	188	$2,750	2	1	3.15	3,735	1,183	161
	4[1]	1	40.7	29.5	4.9	6.6	13.5	4.8	.....	.....	.....	.....	.....	1	1	4.77	14,232	2,986	563
	5[1]	1	34.6	34.4	4.8	20.6	.....	5.6	.....	75	35.20	.....	.....	1	1	5.38	18,129	3,365	387
	6[2]	1	15.4	16.4	5.6	62.6	.....	.....	1	180	27.80	180	5,000	3	1	5.39	6,851	3,267	266
Total and average	.....	8	23.8	30.8	4.8	29.5	3.1	7.9	2	443	23.30	184	3,875	9	6	4.19	7,014	1,675	328
5,000 to 20,000 customers	7[1]	1	7.9	0.2	0.7	25.8	.....	65.4	1	1,060	19.35	1,060	20,500	2	1	6.77	14,116	2,078	522
	8[3]	10	0.9	1.6	0.6	61.0	.....	35.9	2	10,500	21.40	5,250	112,500	2	1	2.21	8,465	3,783	196
	9[4]	30	5.9	7.5	0.7	84.2	0.6	1.1	3	6,100	29.55	2,033	60,000	3	.....	3.34	6,992	2,139	479
	10[5]	1	8.2	16.4	0.1	30.2	23.2	21.6	2	1,550	25.80	775	20,000	8	1	9.50	15,562	1,675	308
	11[5]	2	5.3	4.8	1.3	22.8	.....	65.8	1	7,500	6.65	7,500	50,000	12	3	12.79	15,277	1,196	270
Total and average	.....	44	3.8	4.6	0.6	50.5	2.8	37.8	9	26,710	19.30	2,967	57,300	27	6	8.24	13,830	1,680	322
20,000 to 50,000 customers	12[5]	10	7.1	16.8	0.1	59.9	14.9	1.2	1	1,500	7.10	1,500	10,600	17	2	10.28	11,703	1,180	219
	13[5]	6	17.5	25.1	4.2	43.1	.....	10.1	8	1,150	52.10	144	7,500	25	19	11.10	9,687	1,990	284
	14[3]	1	6.1	3.1	2.2	33.8	2.7	52.1	4	10,527	26.10	2,650	68,750	7	1	13.10	46,877	3,790	389
	15[3]	100	5.4	8.4	1.9	76.5	4.4	3.4	1	.....	.....	.....	.....	11	19	17.50	36,727	2,165	244
	16[4]	15	6.1	13.7	0.7	54.4	24.0	0.9	5	14,081	26.60	2,960	75,000	11	3	3.53	12,472	3,522	306
Total and average	.....	132	6.8	10.4	1.4	52.5	11.5	17.4	19	27,258	26.50	1,435	37,980	71	44	10.30	18,760	1,830	297
50,000 to 100,000 customers	17[6]	100	1.4	3.5	0.3	53.4	.....	41.4	9	25,230	39.60	2,810	111,000	30	55	9.48	11,951	1,280	324
	18[6]	17	6.9	5.5	1.7	57.6	7.5	20.9	3	6,500	39.80	2,160	86,600	25	9	7.45	15,261	2,050	318
	19[3]	50	4.7	5.2	1.2	70.6	1.1	16.2	15	37,000	26.45	2,460	65,250	12	1	5.08	19,172	3,775	474
	20[6]	14	4.2	8.1	1.0	72.4	.....	14.3	10	19,500	43.50	1,950	85,000	106	12	21.15	11,088	521	371
	21[7]	3	8.2	7.9	5.3	34.2	23.8	20.6	2	16,950	17.40	8,475	165,000	21	2	4.68	11,978	2,561	301
Total and average	.....	184	3.9	5.4	1.3	59.5	3.2	27.1	39	105,180	32.50	2,720	87,500	194	79	9.81	12,320	1,270	356
More than 100,000 customers	22[7]	3	14.7	23.8	3.9	52.0	.....	5.6	5	9,000	33.40	1,800	60,000	135	14	13.70	8,561	621	328
	23[5]	1	13.5	16.3	3.6	60.2	0.1	6.3	6	16,000	7.80	2,660	21,000	35	1	6.89	18,144	2,620	428
	24[2]	640	14.4	17.3	4.6	55.4	0.5	7.8	15	31,000	26.60	2,060	57,000	151	34	4.74	7,565	1,595	338
	25[7]	12	11.9	15.1	1.6	42.2	0.4	28.8	13	37,715	27.25	2,900	92,500	22	17	4.31	38,007	8,800	405
	26[6]	170	12.1	14.9	2.4	54.9	11.8	3.9	7	50,000	33.00	7,150	235,000	60	61	1.56	10,029	6,420	453
Total and average	.....	826	12.7	16.2	2.8	52.6	5.5	10.2	46	143,715	28.90	3,100	89,500	403	127	4.39	10,860	2,470	403
Grand total and averages	.....	1,194	8.6	11.2	1.9	54.8	5.1	18.4	115	303,306	$29.05	2,637	$76,515	704	262	$5.96	$12,120	2,040	382

Types of territories served:
[1]Small or medium-sized city, mostly urban territory.
[2]Small or medium-sized city, with industrial development.
[3]Medium-sized city and outlying communities, including rural.
[4]Medium-sized city with industrial development.
[5]Medium-sized city, no large industries.
[6]Large city with important industrial activity.
[7]Large city, no large or dominating industries.

power salesmen employed by each company and the total kilowatts of new power load added the relations between number of men and the value of the new business contracted for per man may be seen. In studying this chart it should be noted that the five companies having more than 100,000 customers are quite evenly graduated in size from about 105,000 to approximately 450,000 customers and their respective increases in power load are very nearly in direct ratio to their size. The significant feature of this diagram is that in those companies whose power salesmen show exceptionally high figures in added load and revenue per man — 8,475 kw. and $265,000 respectively — the total power load added has not been nearly so large in proportion to their size as in those companies whose individual salesmen are not credited with such high values in load and revenue.

In some of the large systems there is a tendency to use proportionally fewer men, which reflects in larger blocks of new business per man. There are four companies in which each power salesman contracted for additional power load returning in excess of $100,000 gross annual revenue. This is well above the average for any of the groups. When compared with Company 20, which shows a high value per kilowatt of connected load, $43.50, and a satisfactory performance per man in 1,950 kw. contracted for with an anticipated gross revenue of $85,000, it would seem that it is possible for the power sales engineer to spread his efforts out too thin. That is, an exceptional showing has been made by the individual power salesman, but the total loads added by these companies have not been relatively so great as those in companies whose sales engineers do not handle so large a volume of business.

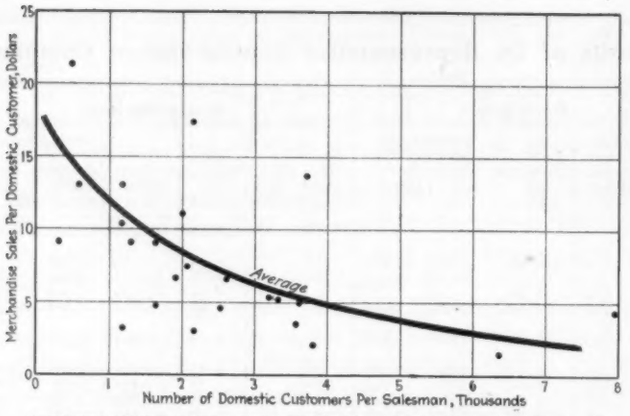
Scanning the figures for individual companies in Table I shows that the annual accomplishment per power

Table II—Kilowatt-Hour Sales per Domestic Customer and Merchandising Activities for Different Size Localities

Size of Company	Annual Revenue per Kilowatt of Power Load Added	Amount and Value of Power Load Added per Man: Kilowatts	Amount and Value of Power Load Added per Man: Annual Revenue
Less than 5,000 customers	$23.30	184	$3,875
5,000 to 20,000 customers	19.30	2,967	57,300
20,000 to 50,000 customers	26.50	1,435	37,980
50,000 to 100,000 customers	32.50	2,720	87,500
100,000 to 500,000 customers	28.90	3,100	89,500
Average	29.05	2,637	76,515
Minimum	6.65	180	2,750
Maximum	52.10	8,475	235,000

New power load returns annual gross revenue of $29.05 per kilowatt.
Each power salesman contracts for 2,637 kw., returning $76,515 revenue.

Size of Company	Kilowatt-Hour Sales per Domestic Customer	Merchandise Sales per Domestic Customer	Merchandise Sales per Salesman	Number Domestic Customers per Salesman
Less than 5,000 customers	328	$4.19	$7,014	1,675
5,000 to 20,000 customers	322	8.24	13,830	1,680
20,000 to 50,000 customers	297	10.30	18,760	1,830
50,000 to 100,000 customers	356	9.81	12,320	1,270
100,000 to 500,000 customers	403	4.39	10,860	2,470
Average	382	5.96	12,120	2,040
Minimum	161	1.56	2,741	307
Maximum	563	21.15	46,877	8,800

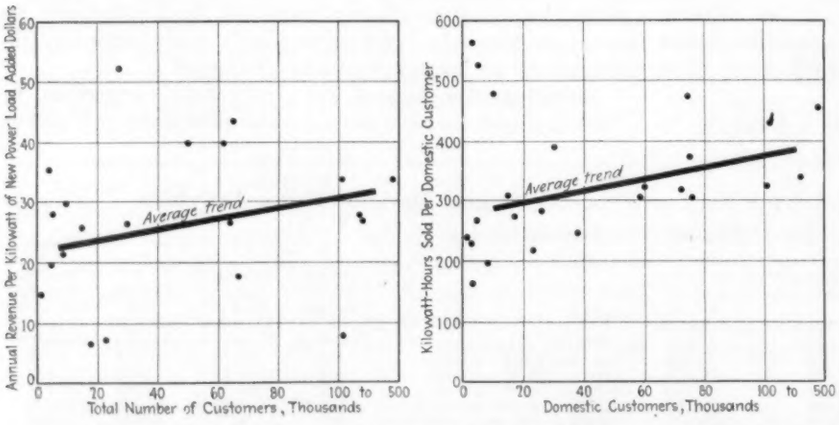


MERCHANDISE SALES PER CUSTOMER DECREASE RAPIDLY AS APPLIANCE SALESMEN WIDEN THEIR TERRITORIES

salesman most usually is in the neighborhood of 2,500 kw. in connected load with a gross annual revenue of about $75,000. There are wide variations above and below these figures, but the average for all companies as given in Table II indicates a yardstick with which it is possible to measure and compare the operations of power sales departments. The annual revenue per kilowatt of power load added is $29.05 and the power load contracted for per power salesman is 2,637 kw., having an anticipated gross annual revenue of $76,515.

As conditions always are different, these figures cannot be taken as an absolute measure of power sales department efficiency. They do, however, provide a basis for comparison of results in different companies and may be used not so much as a measure of the efficiency of individual salesmen but to determine whether the power sales department is adequately equipped. It should be much more satisfactory to an electric utility for each power sales engineer to contract for only 1,500 kw. with $45,000 revenue and be sure that the industrial load was being properly developed and serviced than to have him turning in two or three times that amount of business but have the territory poorly covered.

Any comparison of kilowatt-hour sales to domestic customers must take into consideration the rates for this class of service. In the accompanying chart of domestic energy sales those showing less than 250 kw.-hr. per customer have rates of eight cents or more, whereas those in excess of 300 kw.-hr. have rates of seven cents or less, in some instances as low as four cents. There is a definite relation between the domestic energy consumption per customer and the size of the system, as referred to previously. The relation between energy and merchandise sales per customer cannot be judged without records covering a period of several years, but it should be borne in mind that it is only within the last year or eighteen months that power companies have concentrated their merchandising efforts on such load-building appliances as the range, refrigerator and ironing machines. Theretofore much of the central-station appliance sales volume was made up of those devices that contributed a high merchandising income but were relatively unproductive of greatly increased energy consumption. Similar data when available from companies that during 1926 have been actively engaged in the sale of load-building appliances would show definitely the effect of merchandising activity.


Annual Revenue Per Kilowatt of New Power Load Added Dollars
Average trend
Total Number of Customers, Thousands
Kilowatt-Hours Sold Per Domestic Customer
Average trend
Domestic Customers, Thousands

LEFT—REVENUE PER KILOWATT OF ADDED POWER LOAD GRADUALLY INCREASES WITH SIZE OF SYSTEM. RIGHT—RELATION OF DOMESTIC ENERGY SALES TO NUMBER OF CUSTOMERS ON SYSTEM

CONCLUSIONS AS TO COMPARISONS POSSIBLE

Merchandise sales per customer are in almost direct ratio to the number of appliance salesmen per thousand customers. The company having the highest merchandise sales per customer, $21.15, employs one salesman for every 521 customers, whereas the company that sells only $1.56 of electrical devices per customer employs but one salesman for every 6,420 customers. As a group, companies having between 20,000 and 50,000 customers are getting the best results from their merchandising departments. The sales per customer average $10.30; each salesman disposes of $18,760 of electrical devices per year and covers a territory of 1,830 customers. The average for all the companies does not show up nearly so well. Merchandise sales of $5.96 per customer, $12,120 per salesman with 2,040 customers can hardly be considered particularly efficient merchandising operation, and although these figures may be used as a basis of comparison, a larger number of companies have recorded much more satisfactory and better balanced results.

The foregoing data on industrial power and merchandising sales by 26 central-station companies should not be construed absolutely to represent good or poor over-all commercial efficiency. The figures do show high and low extremes, and mean averages have been taken upon which it is possible to make definite comparisons of some of the important phases of new business operations. The wide range between minimum and maximum results in domestic energy, power and merchandising sales leads to the conclusion that not all companies are getting the most out of their territories. When it is considered that on a national basis the present available market for the utilization of electrical energy for all purposes is only 10 per cent developed, the need for still more intensive and extensive commercial endeavor becomes at once manifest.

As systems and revenues increase from year to year, the scope and man power of central-station new-business departments should be increased to insure the continued growth and prosperity of the industry.

Experience with Trenton Channel

Thermal Efficiency and Operating Costs During Eighteen Months Better than Calculated —Reason for Steam Pressure—Direct-Current Auxiliaries Favored —Well Satisfied with Powdered Fuel

By ALEX DOW
President Detroit Edison Company

TRENTON CHANNEL plant has been in operation for two years. The first six months' operation was interfered with by construction work and by the adjustments which always have to be made after a plant is running. During the later eighteen months two of the first three turbo-generator units (50,000 kw., 62,500 kva., 1,200 r.p.m.) have been continuously available. The other unit was continuously available until it was taken out of commission two months ago, after the fourth unit went into commission, to permit replacement of shaft packing on the high-pressure end of the cylinder and the first wheel, both of which were damaged eighteen months ago but not so severely as to prevent operation. The following notes of experience can, therefore, be accepted as based upon eighteen months practical service of three units and an output of 1,002,000,000 kw.-hr. in that period.

The plant is designed for six identical 50,000-kw. turbo-generators. The turbine room was completed during 1926 to accommodate all six; the boiler room has been completed for the necessary number of boilers; the fourth turbo-generator (50,000 kw., 75,000 kva., 1,200 r.p.m.) is in commission as previously stated; the fifth turbo-generator is being erected, and the sixth is under order.

Results Exceed Calculations

The precalculated thermal efficiency of 16,000 B.t.u. per kilowatt-hour of net output at a generator voltage of 12,000 to 13,000 has been excelled in actual operation. This result has been obtained with an annual load factor of 58 per cent, which means that the station took some ups and downs.

The operating cost, including all maintenance costs, has been similarly less than the calculated figures, which means that it has been possible to operate and maintain the plant with the estimated number of employees working the estimated number of hours and without unforeseen expense for maintenance material. In the design (as was frankly said at the time) there was no attempt to make a record either in terms of thermal units or of man-hours. What was sought was a smoothly operating plant with low total costs. Inasmuch as the plant is not yet finished, I am not offering any final figure of cost per kilowatt or per kilowatt-hour.

Our theory of operation does not allow us to make a base-load plant of Trenton Channel. We shall be tempted to have a base-load plant at Delray if we ever get around to rebuild that plant. But we observe that the base load plant of today becomes the standby plant of five or ten years hence, and we shall deal with the base-load problem as and when we come to it, without making it the excuse for costly design.

The single-cylinder turbine makes good use of steam up to about 400 lb. pressure. If we were to select a higher pressure, we would use two cylinders, either tandem or cross-compound. The 400-lb. figure was chosen because it appeared to represent the upper limit for a single-cylinder turbine and because it also represented the point at which the standard method of making riveted boiler drums with planed joints and double-butt straps and turned and fitted heads could be applied to our well-known Delray type of boiler, with drums of a diameter of 48 in. The plate is 2 in. thick. At higher pressures smaller drums would have been necessary, which would have required the use of a smaller number of 3¼-in. tubes (that is to say, a smaller boiler), unless the number of drums per boiler were multiplied—or else forged drums would have had to be used. I do not think there is any principle of design implied by this observation that 400-lb. gage pressure marks the line above which the manufacturing costs of turbine and boiler must step up quite sharply. I think the coincidence is accidental.

For Direct-Current Auxiliaries

We have had more comment by visitors concerning our direct-current auxiliary system than concerning any other feature. These 4,000-kw. twin generators, direct-current, driven by cross-compound geared turbines, do look expensive. Any visiting designer of plants who had a pencil handy would figure to us that our auxiliary system was costing too much. But visitors who were responsible for day-to-day operation of their own plants were likely to say that they would be glad to exchange their own auxiliary arrangements for the exceedingly simple control and switch equipment which we showed them, for the 250-volt copper busbars carried by Alberene stone cleats and insulated with cotton duck stitched on by a sailmaker, and for the absence of oil-filled switches and alternating-current safety devices.

The direct-current generators are run up to speed and put on to the auxiliary system in the most casual way by an engine-room attendant. When one of them is to be taken off, all that is done is to shut the throttle. A reverse-current relay trips the circuit breaker so soon as there is a few amperes of reversed flow of current. The range of speed of the direct-current auxiliary motors is anything that is wanted up to the one-to-four ratio of the motors feeding the pulverized-coal burners, and the motors are efficient at low speeds. With the exception of one generator commutator which misbehaved (possibly in order to prove the rule), there has been literally no commutator trouble. The starting and speed-control gear is placed wherever convenient. It is absurdly simple, and any electrical part of the 250-

volt direct-current auxiliary system can be handled without gloves.

Our friends who have adopted the method which is at the moment considered to be the most efficient—namely, the use of a house alternator on an extension of the main turbine shaft—say that the efficiency is all right but the convenience is something else again. They say that they do not, in practice, synchronize these house generators with one another because the phase angles of the corresponding main generators may not coincide. Therefore they use separate busbars and throw-over switches. They say likewise that the saving in using alternating-current conductors at 2,300 volts is largely offset by the cost of switchgear and relays.

ATTITUDE ON PULVERIZED FUEL

The operation of the pulverized-fuel plant is successful and satisfactory and concurs with all the assumptions made by us in advance. If we had to build a similar plant today, we would, I believe, repeat the choice of a separate preparation house. If the decision were to be made a year hence, I think that we might choose unit pulverizers.

The air-cooled furnaces had minor troubles due to local overheating. These have been minimized by better arrangement of the air ducts. If we were designing a new plant today, we would probably use water cooling in the furnace walls, although possibly we would not use the entirely water-cooled furnace with these type W Stirling "Delray" boilers, rated at 2,909 hp. each. The separated hearth screens work well, and our experience with them justifies our opinion that it is best (at least with very large boilers) to have any furnace water-cooling system separately fed and not to link it into the water circulation of the main boiler.

The Cottrell precipitators in their earlier form were decidedly temperamental, but the later form promises to be reliable. They intercept a fine grit which proves, upon analysis, to carry a fairly constant amount of carbon. The claim of automatically perfect combustion of pulverized fuel is not justified, and we did not calculate that it would be. The advantages which we really expected—a wider choice of fuel, great flexibility in operation and reduction of standby losses—have been realized. The every-day output of steam from each boiler has been greater than expected. We take 25,000 kw. regularly out of each boiler. Our allowances for possible trouble with refractories and for possible difficulties with certain classes of fuel were too conservative. The immediate result of this is that we will for the present install only fourteen boilers instead of eighteen. We can see, however, that the possibility of installing more boilers may be helpful in case changes in fuel markets or fuel freight rates make it profitable for us to use a lower grade of coal. Also, with the dust and noise of fuel preparation confined to a separate house, it is easy to make a boiler room look as it should. Even the necessary repairs are made with less mess than in our best stoker plants.

At Trenton Channel we have no difficulty in disposing of the fine grit recovered from the precipitators and from the dust passages of the boilers. We sluice it into a lagoon which we are filling, and we have more lagoons and marsh lands to fill. But at the city plants where we now use stokers we are not required to dispose of our cinders at our own cost. There is a market for them. A carload of cinders—say 50 cu.yd.—sells on our side track for $35 during the months when building construction is active, and in Detroit it is active during all the year. There is also a well-developed industry making and marketing a cinder-concrete brick which asks for more cinders than we have for sale. Some one will have to discover a commercial use for the fine grit from the Cottrells before we can install pulverized fuel at, say Delray, where there is no lagoon to fill.

To complete these comments on pulverized fuel, I am going to answer one question which has been asked us by our visitors and avoid answering another such question. The first question is whether we, after having acquired experience during two years' operation of a large plant with pulverized fuel, are satisfied that we did well in choosing pulverized fuel instead of the best of the stokers which were available. The answer is yes, and there is no qualification whatsoever to that answer. The decision was well and wisely made. In saying this we are taking account of recent improvements in stoker practice as well as of our experience with pulverized fuel. The other question is whether we shall choose stokers or pulverized fuel for our next plant or our next addition to an existing plant elsewhere. We will cross that bridge when we come to it. In the meantime we do not answer.

EXPERIENCE WITH CONDENSER AUXILIARIES

The single-pass condensers, of course, introduce no new condenser problems, but the low level of the Detroit River and some specialization in the plant design have led to their operating during week ends with a siphon discharge of approximately 30 ft. In connection with the new units, instead of putting the extraction pump on the same shaft as the feed pump, we are driving it electrically from a small alternating-current generator carried on the feed-pump motor shaft. This permits the extraction pump to be placed directly below the condenser and yet to keep in step with the feed pump.

Trenton Channel is one of the few large plants using steel-tube economizers and not using de-aërators. Make-up water is distilled as usual, and the surge tanks are protected as well as is conveniently possible from access of air to the stored water. The condensers are evidently removing air to a sufficient degree to safeguard the economizers, but our experience indicates that this detail of operation needs careful supervision. The rotating dry-vacuum pumps with vertical cylinders, motor driven, are an improvement on the horizontal type, in that they occupy less space. Our persistent use of rotating pumps is another matter in which our design has been criticised as costly, but we have not yet seen anything equally good. Of course, we are watching the improvements in steam-jet devices for removing non-condensible vapors. In making the joints on the 400-lb. steam-pipe lines we adhered to our practice of using a Van Stone joint with a thin fabricated gasket. These joints are all right at the higher pressure and we are continuing their use.

CONCLUSION

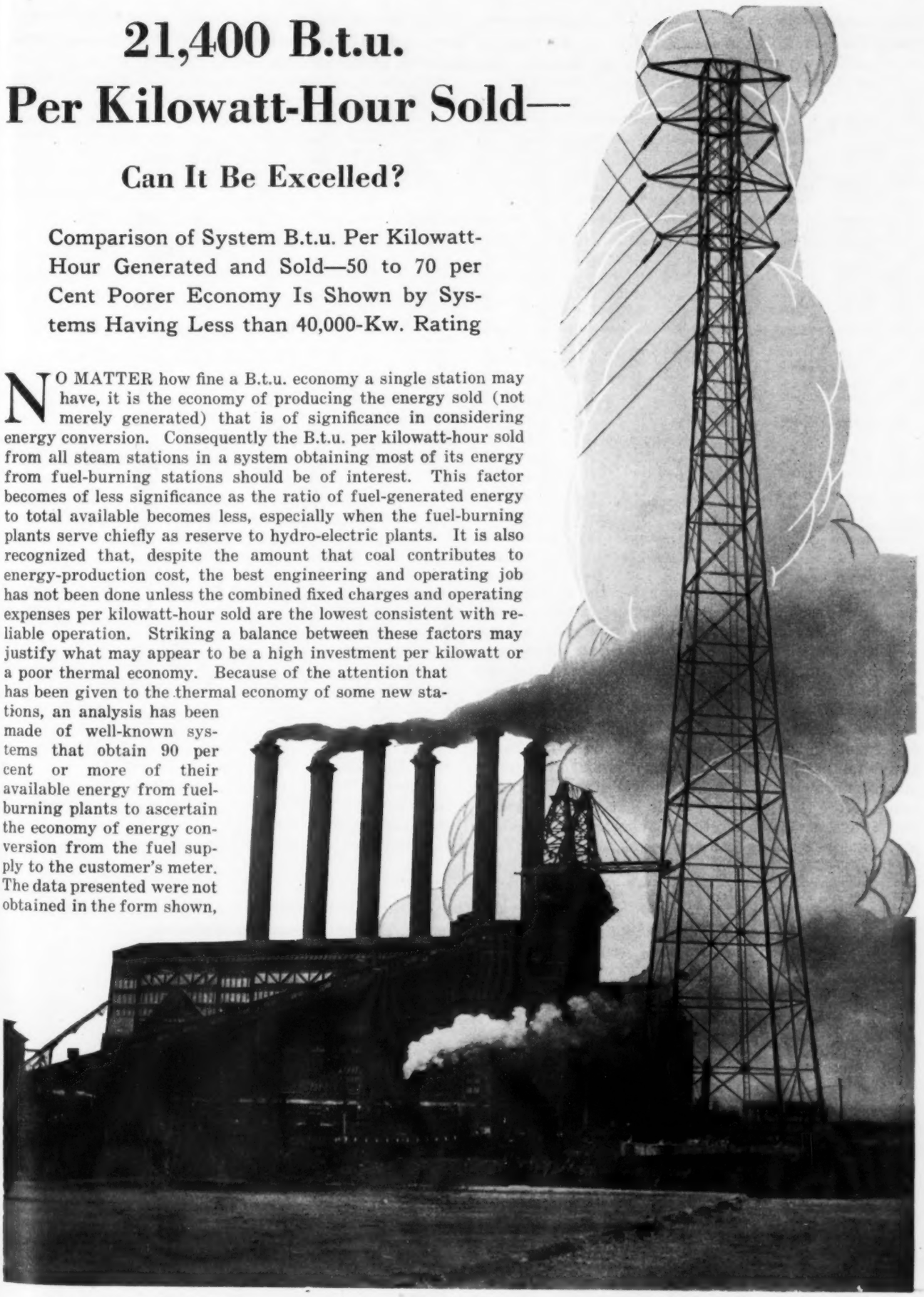
The Trenton Channel plant thus far has furnished no surprises to its designers and has done a little better than the estimates—as might be expected of new machinery well handled. What it will continue to do after it is doubled in capacity and its full-load operating and maintenance régime is established is a question that cannot be answered now, but will be answered willingly when the time comes.

21,400 B.t.u. Per Kilowatt-Hour Sold—

Can It Be Excelled?

Comparison of System B.t.u. Per Kilowatt-Hour Generated and Sold—50 to 70 per Cent Poorer Economy Is Shown by Systems Having Less than 40,000-Kw. Rating

NO MATTER how fine a B.t.u. economy a single station may have, it is the economy of producing the energy sold (not merely generated) that is of significance in considering energy conversion. Consequently the B.t.u. per kilowatt-hour sold from all steam stations in a system obtaining most of its energy from fuel-burning stations should be of interest. This factor becomes of less significance as the ratio of fuel-generated energy to total available becomes less, especially when the fuel-burning plants serve chiefly as reserve to hydro-electric plants. It is also recognized that, despite the amount that coal contributes to energy-production cost, the best engineering and operating job has not been done unless the combined fixed charges and operating expenses per kilowatt-hour sold are the lowest consistent with reliable operation. Striking a balance between these factors may justify what may appear to be a high investment per kilowatt or a poor thermal economy. Because of the attention that has been given to the thermal economy of some new stations, an analysis has been made of well-known systems that obtain 90 per cent or more of their available energy from fuel-burning plants to ascertain the economy of energy conversion from the fuel supply to the customer's meter. The data presented were not obtained in the form shown,



ENTIRE OUTPUT OF NEW KEARNY STATION, NEW JERSEY, DELIVERED TO HIGH-TENSION LINE SERVING AS STATION TIE

Table I—System B.t.u. Per Kw.-Hr. for 25 Systems Deriving 90 Per Cent or More of Their Energy from Fuel-Burning Generating Stations (Arranged in Order of Generating Capacity)

Item	System Btu. Per Kw.-Hr. Generated by Fuel	System Btu. Per Kw.-Hr. Sold from Steam Stations	System Loss (Per Cent)	System Loss Plus Intra-Company Use (Per Cent)	Source of Energy: Steam Stations (Per Cent)	Source of Energy: Hydro-Stations (Per Cent)	Source of Energy: Purchased Power (Per Cent)	Energy Sold to Other Utilities (Per Cent)	Average System Load ÷ Steam Station Rating (Per Cent)	System Peak ÷ Steam Plant Rating (Per Cent)	Total No. Steam Plant Generating Units	Kind of Fuel Used	Unit Cost of Fuel (Approx.)	Kw.-Hr. Per Meter (Aver.)	No. Meters Per Trans. Mile (> 11 Kv.)	Steam Station Rating (Approx.)
1	34,300	53,800	7	15	100	0	0	15.3	29	108	2	Oil	2.10/bbl.	875	City sys.	1000 to
2	18,900	24,100	10	24	100	0	0	0	17	56	8	Oil	1.65/bbl. 2.78/bbl.	582	City sys.	2000 Kw.
3	30,500	41,800	16	27	100	0	0	0.9	35	74	7	Coal	3.25/ton	6750	23	
4	27,800	35,700	13	22	100	0	0	11.8	41	81	9	Oil	1.40/bbl.	2960	645	
5	32,900	40,000	9	18	96	2	2	3.6	16	48	3	Coal	6.75/ton	1650	City sys.	
6	24,100	32,000	13	22	100	0	0	12.0	43	88	4	Coal	5.25/ton	1795	428	
7	32,500	36,200	10	11	99	0	1	24.0	35	83	8	Coal	3.75/ton	2940	1250	16,000
8	34,600	46,000	17	25	99.98	0.01	0.01	2.2	26	60	9	Coal	3.50/ton	....	....	—40,000
9	38,200	53,000	17	28	99	0	1	0	21	57	4	Coal	2.75/ton	2135	City sys.	Kw.
10	26,500	36,600	13	28	89	0	11	27	20	41	5	Coal	5.50/ton	2120	393	
11	29,000	32,200	....	11	100	0	0	0	33	64	9	Oil and gas	.0338/gal. 22.4/M.	1280	City sys.	
12	26,100	31,400	16	16.3	99	0	1	0.5	15	45	9	Coal	6.25/ton	1845	865	
13	19,700	21,800	9	9.3	94	0	6.0	1	51	112	3	Oil and gas	1.43/bbl. 16/M.	2450	Chfly. City system	
14	19,600	24,900	14	21	100	0	0	0.5	26	59	9	Coal	3.00/ton	2520	306	
15	25,400	28,400	10.3	10.6	98.6	0	1.4	3	16	43	5	Coal	2.25/ton	2810	175	40,000—
16	31,200	35,300	11	11	100	0	0	15	26	47	8	Coal	4.50/ton	2880	980	200,000
17	22,900	27,000	15.3	15.7	99	0	1	0	19	52	7	Gas and oil	1.20/bbl. 16/M.	1270	910	Kw.
18	21,000	25,300	15	17	100	0	0	1.8	36	81	9	Coal	5.00/ton	1830	73	
19	18,500	21,400	13	13.5	100	0	0	21	35	72	44	Coal	4.50/ton	3480	286	
20	19,300	22,500	7	15	100	0	0	10	35	76	21	Coal	3.50/ton	3320	1480	
21	20,300	23,700	10	15	99.5	0	0.5	4	43	82	30	Coal	3.50/ton	4365	416	More than
22	21,200	24,900	17	17.5	93	0	7	24	41	92	64	Coal	6.00/ton	1490	760	200,000
23	19,500	23,300	15	16	99	0.85	0.15	4	39	77	21	Coal	4.00/ton	3170	417	Kw.
24	19,900	23,750	15	15.8	99.9	0	0.1	19	30	73	54	Coal	5.50/ton	2560	City sys.	
25	19,800	22,650	9.8	10.2	97.4	0	2.6	5	40	89	..	Coal	4.00/ton	3090	City sys.	

so there was not the temptation for the operators to show good results. On the contrary, the data were based on primary statistics that are likely to be most reliable. For example, the B.t.u. per kilowatt-hour were based on coal consumption, coal analysis and energy actually delivered from the station busbars or billed to the customers, as the case may be.

Since station economy, distribution and conversion losses and intracompany use are involved in the system B.t.u. per kilowatt-hour sold, it is essential to consider the primary factors, but a few observations can be made before this is done. One is that (with the exception of system 16) the systems having more than 40,000 kw. total generating capacity show the lowest B.t.u. per kilowatt-hour sold, the average for those systems above 200,000 kw. being about 23,000 B.t.u. per kilowatt-hour. System 19 shows the best system economy per kilowatt-hour sold, namely, 21,400 B.t.u. From 16,000 to 40,000 kw. rating, the B.t.u. per kilowatt-hour sold are much higher, running as much as 53,400 B.t.u. per kilowatt-hour in one case, and not dropping below 31,500, the average being 39,000. This average is nearly 70 per cent poorer than for the systems having more than 200,000 kw. generating capacity.

The distribution and conversion losses, which account in most cases for the difference between B.t.u. per kilowatt-hour generated and sold, run 17 per cent or under for the systems graphically represented, averaging

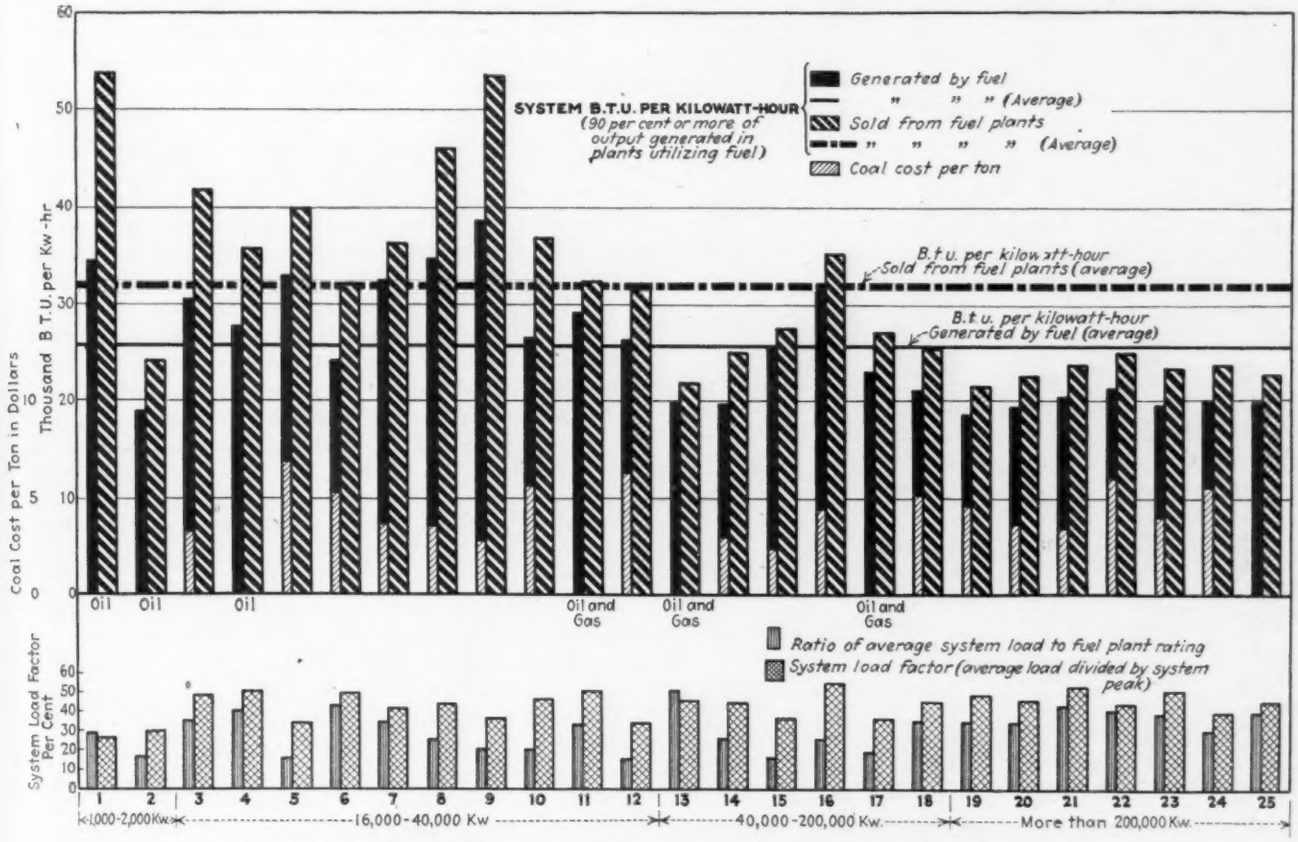
Table II—As the Percentage of Energy Generated in Steam Plants Becomes a Smaller Percentage of Total Energy Available the Importance of Thermal Economy Reduces

(Systems obtaining less than 90 per cent of energy from steam plants)

Item	System Btu. Per Kw.-Hr. Generated by Fuel	System Btu. Per Kw.-Hr. Sold from Steam Stations	System Loss (Per Cent)	System Loss Plus Intra-company Use (Per Cent)	Source of Energy: Steam Station (Per Cent)	Source of Energy: Hydro Station (Per Cent)	Source of Energy: Purchased Power (Per Cent)	Energy Sold to Other Utilities (Per Cent)	Average System Load ÷ Steam Station Rating (Per Cent)	System Peak ÷ Steam Station Rating (Per Cent)	Total No. Steam Station Generating Units	Kind of Fuel Used	Kw.-Hr. Per Meter	No. Meters Per Trans. Mile (> 11 Kv.)	Approx. Steam Station Rating (Kw.)
25	18,300	22,200	13	18	88	0	12	17	48	108	14	Coal and gas	3565	102	135,000
26	26,200	31,800	11	15	88	11	1	15	33	73	7	Coal	6000	City system	30,000
27	33,100	41,300	12	15	88	9	3	10	17	..	21	Coal	1310	65	30,000
28	33,300	38,650	13	13.6	69	0	31	4	45	78	11	Coal	3500	78	45,000
29	32,200	37,400	11.5	13.8	53	15	32	8	18	..	4	Coal	1800	City system	55,000
30	29,100	37,800	21	23	50	43	7	8	38	75	59	Coal	1890	32	225,000
31	24,300	29,600	16	19	49	46	5	41	65	134	11	Coal	1800	50	200,000
32	23,000	25,000	7.4	7.5	46	0	54	58	48	64	13	Coal	4670	963	290,000
33	42,200	50,200	7	10	33	0	67	8	64	167	..	Coal	1950	City system	6,000
34	22,000	27,200	19	19.3	31	0	69	15	98	185	42	Coal, oil and gas	3210	39	30,000
35	25,000	28,750	12	12.2	24	0	76	0	94	179	4	Coal	4910	City system	105,000
36	28,300	35,700	20.2	20.6	19	69	12	16	115	207	3	Coal	6670	10	55,000
37	50,500	55,200	28.1	29.2	17	79.5	3.5	15	208	743	5	Coal	5300	53	15,000
38	31,500	34,500	7.9	8.5	11.7	55.4	32.9	5	26	...	2	Coal	23,000	City system	10,000
39	44,400	57,200	18.7	20.6	9.9	88.4	1.7	54	39	80	15	Coal	4710	22	7,500
40	32,400	41,800	21	22.5	6	76	18	2	170	307	26	Coal and oil	4340	79	40,000
41	31,800	36,300	11.6	12.5	2.6	62	35.4	4.4	434	920	2	Coal	....	..	20,000
42	50,700	61,200	17	17.2	1	1	98	1	198	....	..	Coal	2300	45	2,500
43	51,400	61,200	15	16	0.85	0	99.15	0	480	1160	2	Coal	8800	..	5,000

around 13 per cent in each group. One system (20), having more than 200,000 kw. generated capacity, shows only 7 per cent distribution and conversion losses, whereas system 22 in the same group has 17 per cent. This may be partly explained by the fact that system 22 is spread over a considerable territory and has less than half the energy consumption per meter that system 20 has. The lowest distribution losses in the 40,000 to 200,000 kw. group is for system 13, which is relatively concentrated.

The effect of the distribution and conversion losses on B.t.u. per kilowatt-hour sold indicates that in distribution and conversion is a more fertile field for reducing losses than in the modern power station. Whether the losses can be reduced with less capital investment than in a power station remains to be proved.


SYSTEM B.T.U. PER KILOWATT-HOUR
(90 per cent or more of output generated in plants utilizing fuel)
Generated by fuel
" " " (Average)
Sold from fuel plants
" " " (Average)
Coal cost per ton
B.t.u. per kilowatt-hour Sold from fuel plants (average)
B.t.u. per kilowatt-hour Generated by fuel (average)
Coal Cost per Ton in Dollars
Thousand B.T.U. per Kw.-hr.
Oil
Oil and Gas
Ratio of average system load to fuel plant rating
System load factor (average load divided by system peak)
System Load Factor Per Cent
1,000-2,000 Kw.
16,000-40,000 Kw
40,000-200,000 Kw.
More than 200,000 Kw.

SYSTEM B.T.U.S PER KILOWATT-HOUR SHOW TENDENCY TO DECREASE WITH SYSTEM RATING
Applies to systems deriving 90 per cent of energy from fuel-burning plants.

Some of the systems apparently use unbelievable amounts of energy for intracompany use or dispose of energy for which no revenue is recorded, judging from a comparison of the B.t.u. per kilowatt-hour generated and sold for systems 1, 3, 4, 5, 6, 8, 9 and 10. These systems are chiefly in the group having less than 40,000 kw. generating capacity, it will be observed. Operations other than electric service are performed by these companies, which take energy for which no income is recorded.

B.T.U. Per Kilowatt-Hour Generated

Except for systems 15 and 16, all the systems rated above 40,000 kw. graphically represented show a consistently better system B.t.u. per kilowatt-hour generated than those systems of less rating. Most of this group produce energy at slightly less or more than 20,000 B.t.u. per kilowatt-hour generated, the best economy being 18,500 B.t.u. for system 19, which has a 50 per cent load factor and a relatively high-price coal. System 15 has a load factor about the same as that of system 17, but below the load factors of systems 13 to 24 inclusive. Furthermore, the coal cost is the lowest of the group. This combination may account partly for the lower economy. System 16 has a high coal cost (but no greater than systems 18, 19, 22 and 24) and the highest load factor of systems 13 to 24. These conditions would be expected to call for a higher economy than shown, but both systems 15 and 16 haven't as large or as modern units as the remainder of this group. System 22, which shows slightly more B.t.u. per kilowatt-hour generated than the systems next in size, purchases 7 per cent of its energy, which tends to justify the poorer economy with a high-priced coal.

In the group of systems having less than 40,000 kw. generating capacity, the next to the smallest system (2), which is really a single station using oil engines, shows a thermal economy of less than 19,000 B.t.u. per kilowatt-hour despite a load factor of only 30 per cent. But this departure in economy from systems of the same size is not so surprising, since the thermal economy of a Diesel engine is admittedly high even if there is some argument on the fixed charges and maintenance.

System 6 shows the next best economy of 24,100 B.t.u. per kilowatt-hour with a load factor of 50 per cent, but this system has only four generating units of relatively modern vintage. All other systems in this group have economies of 27,000 B.t.u. or worse. The worst economy (38,200) is shown by system 9, which

is a city system with a load factor of 37 per cent and a relatively low coal cost, which partly justify the poor economy. System 10 purchases 11 per cent of its energy.

Surprisingly, system load factor does not consistently show the effect on economy expected, although it is known that raising the load factor of a single station or unit will improve results. Neither does cost of coal seem to have influence on the relative economy obtained.

Table III—Small Plants Generally Show Low Thermal Economy

Rating (Kw.)	Output Thousand Kw-Hr.)	Load Factor (Per Cent)	Cost of Fuel	No. Units	B.t.u.s. Per Kw.-Hr. Generated
Municipal Plants					
Coal-burning stations					
500	600	25	$4.50	3	120,000
500	900	28	4.50	3	100,000
125	1,500	12	6.50	2	92,000
4,000*	12,000	35	1.20/bbl.	3	89,000
6,000	5,000	54	6.00	3	67,000
3,500	7,000	42	5.25	3	65,000
1,200	2,000	33	3.30	2	65,000
2,500	3,000	28	4.20	3	60,000
1,200	2,000	29	3.50	2	52,000
1,800	3,000	37	4.70	4	47,000
5,000	7,000	45	3.70	2	45,000
5,500	8,000	37	3.25	5	44,000
9,500	22,000	40	4.00	3	40,000
8,000	9,000	35	4.60	3	38,000
2,000	4,000	41	4.00	3	34,000
* Oil burning.					
Oil-engine stations			Per Pbl.		
10,000	12,000	40	$1.70	5	35,000
250	400	41	1.75	2	27,000
750	1,200	30	1.20	2	20,000
1,500	1,600	37	1.70	2	18,000
900	2,000	39	2.50	3	15,500
Small Utility Stations					
Coal-burning					
Rating (Kw.)	Output (Thousand Kw.-Hr.)	Load Factor (Per Cent)	Cost of Fuel	No. Units	B.t.u.s. Per Kw.-Hr. Generated
1,000	1,300	35	$4.75	2	74,000
900	1,500	33	3.50	3	70,000
9,000	5,000	57	10.75	4	66,000
1,000	1,000	36	6.50	3	54,000
8,500	13,000	33	3.50	2	38,000
4,500	6,000	34	3.50	9	33,000
Gas-burning					
300	200	18	$0.15/m.	2	107,000
Oil-engine					
4,300	7,500	36	$2.30/bbl.	14	17,000
Small Privately Owned					
4,400	20,000	34	$4.00	3	102,000
4,800	1,000	15	6.20	2	87,000
1,400	2,500	28	1.00	2	67,000
700	800	15	1.00	2	38,000
600	650	37	2.20	2	36,000
2,200	3,000	20	6.30	2	35,000

As always contended, a number of factors contribute to influencing economy. According to the data presented here, the size of the system is the only single factor that seems to have marked effect on system economy.

These data seem to prove what has always been contended—that a large system generating capacity made up of economical units enables the system to shift loads to the most economical station or unit and thereby secure better system generating economy than when the system is not so constituted. In other words, the 16,000 to 40,000 kw. group shows approximately 50 per cent poorer system generating economy than the group having more than 40,000 kw. generator capacity. (These figures should be compared with similar ones tabulated for small municipal plants and local plants chosen at random and based only on completeness of data furnished and consequent indication of proper record keeping). It is also rather surprising to observe the high system load factors (not station load factors), 17 out of 24 of the systems graphically represented having 40 per cent load factor or better, and six having 50 per cent load factor or better. Those systems below 30 per cent are two small systems rated at 1,000 to 2,000 kw.

For more thorough comparison of these systems, reference should be made to the accompanying Table I, which gives such figures as classification of energy not sold, percentage of energy purchased, per cent sold, number of meters per transmission mile (greater than 11,000 volts), kilowatt-hours per meter, ratio of average system load to steam-plant rating, ratio of system peak load to station rating, and number of generator units available.

It is rather difficult to classify systems as to extent or concentration, so a figure of meters per transmission mile was arbitrarily selected for this purpose. Although it is not a real measure of concentration, it does indicate whether a system involves transmission or not and the possible extent of that system in terms of total meters installed.

The ratio of the system peak load to steam station rating may indicate several things: The generator capacity (or safety factor) above peak load or the existence of generating capacity that is called into use only during emergencies and that may be very uneconomical. If a system has not much margin of generator capacity, it may mean that some uneconomical units are used for a greater percentage of the peaks. Systems 19, 22 and 24 are conspicuous for the number of units available, despite the fact that these are large systems with load carried chiefly on modern large units.

The ratio of average system load to steam plant rating indicates the possibile use-factor that could be obtained with all equipment or the extent to which stations or units can be operated on a base load. Systems 4, 6, 13, 21, 22 and 23 are conspicuous from this viewpoint. Whether a high plant use factor is of relative advantage or not depends to a large extent on whether sufficient modern units are available to take advantage of this high plant-use-factor.

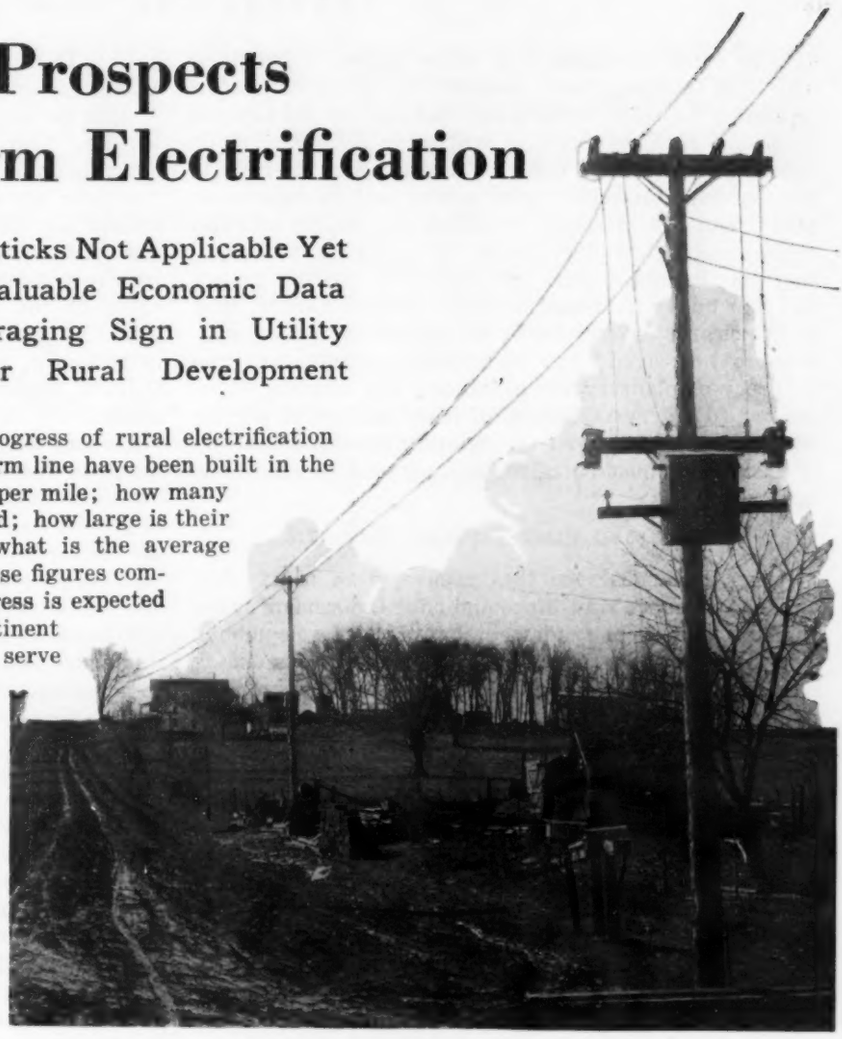
As the amount of energy purchased or generated by hydro-electric plants becomes a larger percentage of the total energy available to a system, there is more justification for a poorer system B.t.u. per kilowatt-hour generated from steam. That this is believed is indicated by the performance of systems securing a large percentage of their available energy from hydro-electric plants or purchasing power.

Electrical Undertakings in Greece

SOME important electrical developments in Greece were announced at the recent annual meeting of the National Bank of Greece in Athens. Thus it was stated that the Syndicate of Studies and Enterprises, presided over by the bank, and the Power & Traction Finance Company, Ltd., of London, had secured from the Greek government a definite concession for electricity supply as well as for reorganizing and exploiting the existing electric railways of Athens, the Piræus and environs and of working the Kephissia Railway by electric traction. The concession holders have founded five new limited-liability companies and have made over to these their rights and obligations under the terms of the concession. With these new companies the corresponding old companies have either been amalgamated or have merely contributed such of their plants as were indispensable.

Progress and Prospects of Farm Electrification

Commercial Yardsticks Not Applicable Yet —Considerable Valuable Economic Data Collected—Encouraging Sign in Utility Organizations for Rural Development



BRINGING ELECTRICITY TO THE FARM

SOME persons interested in the progress of rural electrification will ask: "How many miles of farm line have been built in the last year; what has been the cost per mile; how many new farm customers have been connected; how large is their average kilowatt-hour consumption; what is the average revenue per farm customer; how do these figures compare with past results; and what progress is expected next year?" These are certainly pertinent questions, the answers to which must serve some day as indications of progress. But answers thereto will not give a true conception of progress at this stage of development, as any one recognizes who has closely followed the study of state committees on the relation of electricity to agriculture.

Nevertheless, answers to some of these questions are available from a few sections of the country and are presented for what they may be worth. Most companies have not recapitulated such information yet.

As will happen in such figures as are presented, there appears to be a difference in opinion as to what are farms and what are not and who are rural customers and who are urban customers. Then again, the number of farms served is not an accurate measure of the amount of rural electrification, because in some parts of the country the number of people residing in rural areas is far greater than is the number of those actually engaged in farming.

Important Considerations Involved

Neither are the figures given for cost per mile of constructing a rural line altogether a criterion of the outlay frequently required to consummate such work. Right-of-way costs, the kind of poles, their spacing, size of conductors, operating voltages, lengths of secondary lines, etc., vary radically for different sections of the country. R. R. Young, vice-president in charge of sales of the Public Service Electric & Gas Company, Newark, N. J., advises that with the exception of a few localities in that company's territory there are not very many farms of any size, the majority of these extensions being to small residences and farms along the country road. The company has no special rates for this business and has found with its present line construction, where poles are spaced approximately 125 ft. apart, that there is very little profit in the business. Only recently the company started to make a survey to determine the amount of farm business it is serving.

On the other hand, the average monthly energy consumption of the new farm customers taken on by the Northern States Power Company in Minnesota is estimated to be in the neighborhood of 125 kw.-hr. each. This company, in place of making a definite appropriation for the developing of rural service, has adopted a flexible policy so that money will be available whenever conditions seem to warrant extensions. Whereas about three customers per mile was the correct ratio on the earlier Minnesota rural lines, on the construction undertaken during the past twelve months the average is about 2.8 customers per mile.

Some farms have been developed to the point where they use 3,000 to 18,000 kw.-hr. a year without irrigation.

More significant of rural electrification progress during the past year are the following: (1) Twenty-two state committees* on the relation of electricity to agriculture are now engaged in studying the economics of the situation; (2) considerable valuable data have been collected by them on the economy of various farm applications; (3) nineteen electric-service companies have engaged one or more men to devote full time to rural development work; (4) several companies have organized rural-service departments to give the same recogni-

*All states west of the Mississippi which have extensive farming are included with the exception of North Dakota, Arkansas and Louisiana. State committees are also active in all the states touching the Great Lakes. Except for New Hampshire, Virginia, South Carolina and Alabama, the remainder of the East has no state committees on the relation of electricity to agriculture. It will be observed that most of the states not included are mountainous, arid or have few farm operations that give much encouragement of electrification.

tion to rural development as other classes of business; (5) it is becoming more common for utility companies to finance the lines (up to a certain limit) so the farmers will have cash to purchase utilization equipment; (6) inducement rates are being offered more extensively to develop load profitable from utility and farmer viewpoint; and (7) attempts to reduce the variety of rural rates in contiguous territories. To these signs of progress may be added some that cannot be credited to any one year but to the result of recent intensive study, such as (a) clearer recognition by all parties involved of problems to be solved; (b) increasing interest; (c) the advocacy of planning far ahead and not adopting expedients; (d) a crystallization of ideas on type of service which must be rendered; (e) a more thorough analysis of costs that must be taken into account in rendering service.

MAINTAINING CLOSE CONTACT ESSENTIAL

It has been observed that even after a utility has decided to finance rural lines and offer inducement rates (policies that seem fundamental to rural development) little real progress has occurred in the development of farmers into profitable and satisfied customers unless the utility maintains intimate contact with its potential and actual farm customers. As in any pioneering business where the applications are not well known and experiences may justify modifications of methods, the customer contact has had to be of the co-operative-study, advisory and service type. It has been made possible through the selection by utilities of men with an agricultural engineering background and electrical training who can devote full time to rural development. In some respects their work is an extension of rural-project activities to specific systems with a view toward more immediate development of profitable and satisfied farm customers. Organization of rural-service departments in utility companies is expected to enable this investigational, advisory and commercial development work to be conducted the same as other business activities. Through the medium of existing farm customers and selected prospects, utilities have an excellent opportunity to create great rural interest in applications of electricity to farm operations if they will demonstrate some of the benefits where they can be observed readily by neighboring farmers. Some companies are undertaking this educational or indirect method of commercial development.

A number of operating companies have adopted a rate structure for rural service composed of a relatively high fixed charge including the first 30 kw.-hr. use or so with rapidly decreasing energy-cost steps. This structure has grown out of the faith of those who have intimately studied rural electrification in the possibility of creating a rate that will make the small consumer less of a burden and will encourage large consumptions with benefit to both the farmer and the utility. An attempt has been made to make the rates such that all customers, small and large, will pay their way, but in some cases exigencies of the occasion have compelled reduction of the fixed charge and increase of the energy rates.

Contrasted with, possibly, the majority of persons who believe the rural business should be made self-supporting from the start are a few individuals who believe that a loss might be allowed in the beginning if thereby a profitable load can be developed after a few years. Then there are still fewer who believe that the urban customer will benefit sufficiently in the long run so that he can carry part of the cost of rendering rural service. Gen. Guy E. Tripp's remarks before a Pennsylvania audience suggest a compromise stand. He asks, "Is there any reason why, if it is necessary, the farmer should not obtain his electric service at lower prices [to start] than he would be mathematically entitled to receive and have the deficit for the time absorbed in the rates of the more thickly settled communities?" It would be better for cities to continue present rates a little longer, he contends, to help farmers get service, than to demand reductions which would retard rural service.

Persons who have carefully figured out the investment required and possible return have warned against promiscuous building of rural lines and urged confinement to groups that will agree to use sufficient energy to pay for the service and that will profit by so doing. Fearing that building of rural lines on this basis will eventually lead to a very uneconomic layout, an occasional individual will urge the development of an ultimate plan into which is fitted immediate construction that may not be most economical now but will become so as rural development progresses.

REVIEWING RURAL SERVICE PROBLEMS

As indicating how ideas on rural service are crystallizing, an editorial from the ELECTRICAL WORLD of June 12 is quoted in part:

"Former ideas on rendering electric service to farms are fast going out of date. Development of extensive, profitable, individual utilization of electricity—not scrimping in line construction costs—is the solution. If electric service is to be developed on an income-producing basis for the farmer, power for milking, incubation, operating chore motors, etc., cannot be interrupted or curtailed by inadequate line construction.

"Some short lines may be built for 2,200-volt service, but in general a higher voltage will be necessary. A voltage of 6,600 is considered by some well-informed men to be the minimum advisable to consider. If extensive farm lines and great development of individual farm loads occur, even higher voltages may be required. While single-phase primary service is apparently sufficient for present needs, intensive farm-load development may require three-phase primary service to avoid severe unbalances in three-phase load. At the least, an eye should be kept upon the future by making lines adaptable to the changes that will be needed.

"Except for very heavy duties, which can probably be best handled by community motors served from primary lines through portable transformers, it has been found in Minnesota that a 3-kva. transformer will carry a connected farm load up to 23 kw. and a maximum demand up to 7.9 kw. Whether it is advisable to allow temporary overloads of this magnitude is a question, although it is known that transformers can be safely operated with relatively large temporary overloads. Transformers should preferably be situated in the center of the farm load to avoid excessive secondary voltage drops and line losses. As a consequence, provision will have to be made for mounting meters and main service switches at different locations from those used in cities. Motors rated at 5 hp. have been found adequate for most applications if allowed to carry maximum demands of 4 kw. But the tendency is to reduce

the duties required by various means such as a reduction in the size of driven machines, longer hours of operation (preferably automatic), increased flywheel effect and so forth.

"Three-wire 220/110-volt service is required for most farms, giving 220 volts for power and 110 volts for lighting. Wiring of farm houses will have to be adapted to farm habits and needs, switches being provided where they will be most convenient. Adequate convenience outlets should be installed, and house-lighting fixtures should be of such a type as to discourage connection of electric appliances thereto. Barn lamps should, preferably, be arranged in groups conveniently controlled so that all need not be lighted at once. Yard lights will be a great convenience. Convenient attachment plugs for chore motors will augment the proper use of such equipment. Finally, central-station companies will have to consider how they will maintain rural lines and render emergency service in the winter."

Where will rural electrification first show marked signs of progress? There will probably be as many ideas on this subject as there are persons discussing it. If the answer is confined to self-supporting rural service, it now appears that development may be expected chiefly in those sections where dairying, poultry raising and irrigation abound. As economic farm-power applications become more generally known, the field of development may expand. Unless the financial burden of rural service is absorbed by other than the small farmer, or unless he applies large energy-consuming household uses more extensively than his city cousin, it does not appear now that the small farmer can be served at a rate that is attractive to him and profitable to the utility. Of course, as the number and contiguity of the large consumers in rural districts increase, the problem of the small customer will decrease. In many respects it appears that farm electrification will proceed much as has electrification elsewhere up to the present time. First a fairly concentrated nucleus will be served until the profit permits extension to less profitable sections. As lines are built to serve small towns, these lines, if operating at voltages that permit economical tapping, may possibly be connected to offshoots serving groups of farmers.

Contrasted with the Minnesota figures is that of ten farm customers to the mile, reported by the Puget Sound Power & Light Company as a fair estimate of the conditions upon its lines. The company has 2,901 miles of distribution lines furnishing service to rural territories. However, considerable rural territory is contiguous to cities and contains many more than ten customers to the mile. Therefore, the average for the entire territory would probably be nearer twelve, according to J. W. Payne, company statistician. Approximately 35,000 rural customers are served at the present time.

The type of agricultural activities pursued make a corresponding, and frequently considerable, difference in the amount of electric energy consumed. In central Kentucky, for example, which consists largely of the famous Blue Grass farms, the average farm energy consumption is high, a number of farm customers using about 500 kw.-hr. a month, while in eastern and western Kentucky the contrast of 50 kw.-hr. is significant. The Kentucky Utilities Company has taken on 247 new farm customers in the last twelve months and at the present time operates over 200 miles of strictly farm lines, 15 miles of which has but recently been completed. The company's appropriation for 1927 rural service development has been left conveniently indeterminate, with provision made to meet requirements as the business develops.

A Few Reports on the Progress of Rural Electrification

Judging from costs of lines reported a variety of grades of construction is being used or right-of-way costs differ or are omitted in some cases.

	Adirondack Power & Light Company	Alabama Power Company	Central Illinois Public Service Company	Interstate Public Service Company	Kansas City Power & Light Company	Kansas Gas & Electric Company	Public Service of Northern Illinois	Rutland Railway, Light & Power Company	Southern California Edison Company	Southern Service Company	Utica Gas & Electric Company	Wisconsin Power & Light Co.	Alabama	Minnesota	New York
1. Number of farms in territory served	17,250	188,384	60,000	.....	50,000	.....	31,400	2,000	.....	.....	4,330	51,000	.....	178,400	133,500
2. Number of farms already served	14,045	867[3]	2,900	2,661	600	220	2,301	400	11,847[7]	1,136	800	3,477[11]	2,669[3]	7,500	18,689
3. Number of farm customers taken on in last twelve months	1,870	414	575	478	300	104	.....	100	.....	97	200	759	.....	1,500	.....
4. Total miles of strictly farm line on system now	687[1]	276	650	496.2	150	50	.....	50	.....	.....	122	1,109	.....	.....	.....
5. Number of miles of line built in last twelve months	137[1]	105	190	.....	66	.....	.....	20	.....	.....	22	125	255[3]	.....	7,411[10]
6. Total amount spent for farm lines in last twelve months	$250,000[2]	.....	$57,500[4]	.....	$45,000	.....	.....	$30,000	.....	.....	$35,000	.....	.....	See foot note[9]	.....
7. Average consumption per farm customer per year, kw.-hr.	440	800	393[5]	.....	190	555[6]	.....	400	27,915[7]	.....	340	500	.....	540	.....
8. Appropriation for 1927 rural service development	$195,374	.....	$125,000	.....	.....	.....	.....	.....	.....	.....	$79,000	$475,000	.....	.....	.....
a. Per cent for lines and service	92	.....	80	.....	.....	.....	.....	.....	.....	.....	95	95	.....	.....	.....
b. Per cent for rural development	8	.....	20	.....	.....	.....	.....	.....	.....	.....	5	5	.....	.....	.....

[1] These figures take into consideration lines built in urban territory of 2,500 or less population.

[2] $87,116 actually spent in 1926 for strictly rural lines under company's rural extension plan.

[3] Farms under this company's classification are services to customers living on farms who devote the major portion of their time to agriculture.

[4] Customers spent $115,000 additional.

[5] Made up of 330 kw.-hr. lighting per customer, 1,500 kw.-hr. per cooking installation (80 in all), and 828 kw.-hr. per power installation (75 in all).

[6] Made up of 314 kw.-hr. per residence, 2,436 kw.-hr. per range and 2,000 kw.-hr. per power installation.

[7] These figures refer entirely to consumption of energy for irrigation purposes.

[8] These figures are for 1925 and are included only for purposes of comparison.

[9] Cost of rural line extensions in Minnesota estimated at $1,100 per mile.

[10] As reported by eighteen leading utilities. Involves investment of $14,000,000.

[11] 2,606 farms served directly. 871 served indirectly through farmers' companies.

Letters from Our Readers

Engineer Recognizes Importance of Return on Investment

To the Editor of the ELECTRICAL WORLD:

As an engineer I feel a little resentful about the very interesting article in your Nov. 20 issue by Arnold Pfau on "Engineering Versus Banker Efficiency in Hydro Development." Both the title and the text seem to imply that an engineer may neglect such an all-important consideration as return on investment in pursuing some abstract ideal of efficiency. This immediately raises the questions, "What is an engineer?" and "What is efficiency?"

Engineers are not a superior race, and there are incompetent individuals in the profession just as there are incompetent bankers, doctors and lawyers. But engineers should be, and most of them are, men who deal with practical things in a practical way, and in all commercial matters the idea of maximum return on investment advanced by Mr. Pfau is the elementary consideration. It is an engineer's business to get the most out of a dollar. I do not know just what Mr. Pfau means by "idealistic engineers." I do not see how any one so "idealistic" as to lose sight of practical and economical considerations could be considered an engineer. Even if working on some non-commercial project, like a memorial, the engineer attempts to obtain the desired result in the most economical manner.

A banker may wish that the returns were greater, but there is no difference in their points of view and the engineer produces as much return as he can. It is his business to spend in the most profitable way the dollars which are intrusted to his judgment.

EDWARD J. CHENEY,
Engineer.

New York, N. Y.

A Final Word from Mr. Greene on Cost Analysis

To the Editor of the ELECTRICAL WORLD:

Referring to A. S. Knight's letter in your issue of Dec. 4 on allocating capacity costs, it appears that Mr. Knight is quibbling over the meaning of terms and statements rather than attempting to meet the real issues. The fact that the writer understands Mr. Knight's expression "capacity costs vary uniformly with load factor" as synonymous with the expression "capacity costs vary directly with load factor," and that Mr. Knight has a different understanding, in no way affects the accuracy of the "methods."

I pointed out in my letter of Nov. 13 that if an accurate method of allocation requires the singling out of those who create costs, a resort must be had to the peak responsibility method or some modification thereof. I have stated a number of times clearly and definitely, and stated it as a principle (see page 1190, May 29), that the benefits of uncontrolled diversity are a community of interests. If the "principle" is wrong, the "methods" are wrong, because the purpose of the "methods" is to allocate cost in accordance with the "principle." I cannot make out where Mr. Knight stands on the "principle." He has not attacked it in any of his discussions. In his article "Peak Responsibility as a Basis of Allocating Fixed Costs," which appeared in your March 6 issue, he discarded the responsibility method and adopted the demand method. He is now insisting in one breath that responsibility must receive consideration and in the next advocating the demand method, which gives absolutely no consideration to responsibility. If he does not accept the "principle" he cannot, naturally, be expected to accept the "methods."

Mr. Knight says: "The only two load factors which can possibly connect with costs incurred therefrom are the 100 per cent and the zero per cent load factor." I assume that Mr. Knight intends that some amount should be allocated to the zero per cent load factor for capacity cost, but he has failed to show how a positive connection with costs and zero per cent load factor can be established. I agree with him, however, that it is time the issue was left to the judgment of the readers of the ELECTRICAL WORLD and, in conclusion, I wish to express my appreciation of his part in the discussions, because by them a number of your readers who believe the benefits of uncontrolled diversity are a community of interests have been firmly convinced of the accuracy of the "methods."

W. J. GREENE,
Rate Engineer.

Iowa Railway & Light Corporation,
Cedar Rapids, Iowa.

[This discussion on cost allocation has served to introduce the various phases of the subject and is closed reluctantly with this final letter. The general conclusion is that cost allocations can be made, but that general statements often are misleading when applied to specific conditions. Examples of complete cost allocations and a presentation of other allocation methods will appear in future issues of the ELECTRICAL WORLD.—EDITOR.]

Division of Load in Three-Phase Transformer Banks Further Explained

To the Editor of the ELECTRICAL WORLD:

A number of inquiries have been received relative to the article on "Division of Load in Three-Phase Transformer Banks," published in your issue of Nov. 6 (page 963), indicating that the solution of the diagrams Fig. 1 and Fig. 2, covering unbalanced loads in three-phase banks, was not made sufficiently clear. A further explanation may, therefore, be of interest to your readers.

In Fig. 1, pertaining to delta-delta bank, the derivation of the vectors of current in the line AA_1, BB_1, CC_1 results from simple addition of the given load currents. Their resolution into the components AB, BC, CA can only be effected by trial. Selecting a tentative length and direction for any one, say CA, determines corresponding values for the others by means of the three equations of their vectorial relations to each other and to the vectors AA_1, BB_1, CC_1.

Having these trial vectors AB, BC, CA, draw their respective impedance drop (IZ) vectors, using the impedances of the respective transformers. When the vector sum of these equals zero, indicated by closure of the triangle in the figure, the correct values of the currents have been obtained, and not until then.

The same method of trial applies in solving for the currents AB, BC, CA in Fig. 2, covering star-delta banks, except that the vector sum of the currents themselves must equal zero.

H. S. LANE,
Assistant Engineer.

Pacific Gas & Electric Company,
San Francisco, Cal.

Central Station and Industrial Practice

Safety Record Competition Reduces Accidents

COMPETITION among departments for perfect scores in accident prevention is being used successfully by the Dayton (Ohio) Power & Light Company to maintain observance of safety precautions on the part of employees. For a number of years this company has followed the practice of publishing a monthly safety record of departments or teams representing stations and operating branches, omitting the purely office group, where hazards are at a minimum. Each department is organized into a team competing for a perfect score in lost-time accidents worked out on the basis of the percentage of full time worked.

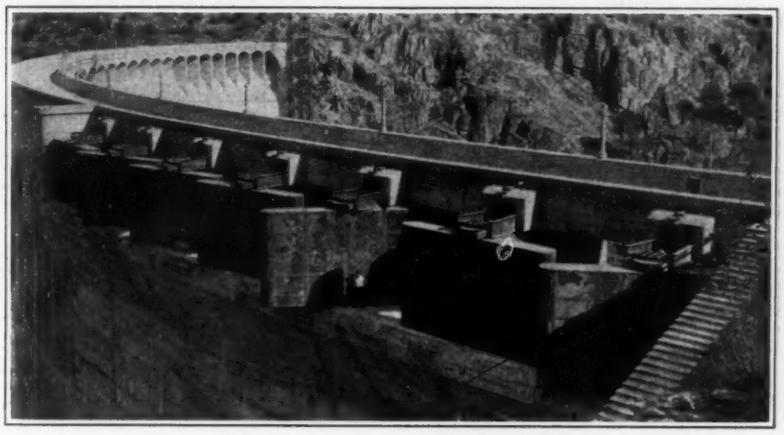
In the August report, which is shown here, eight of the twelve departments had perfect scores, which is somewhat above the average, as usually five or six departments have 100 per cent records. Of the four departments showing lost time three had one accident each during the month and the fourth, Millers Ford station, was penalized 234 hours because of an accident that occurred previous to August. However, the man was off duty in the month concerned and his lost time, as a consequence, is charged against the score.

The eight perfect departments are arranged in the order of their respective hours worked on the theory that the department having produced the greatest number of perfect worked hours is entitled to rank ahead of the department with the fewer perfect worked hours.

This method of maintaining interest in accident prevention has proved so effective that the Dayton Power & Light Company, now a part of the Columbia Gas & Electric Company system, has issued a challenge to other divisions of the Columbia system to participate in a safety record contest in the belief that it will still further increase the observance of safety regulations and individual alertness.

SAFETY RECORD OF DAYTON POWER & LIGHT COMPANY
ISSUED MONTHLY TO EMPLOYEES

Department	Average Number of Employees	Number of Lost Time Accidents	Hours Worked	Hours Lost Due to Accidents Occurring Previous to This Month	Hours Lost Due to Accidents Occurring Current Month	Total Hours Lost	Per Cent of Full Time Worked
Construction	57	0	11,828	0	0	0	100.000
Third Street	32	0	6,527	0	0	0	100.000
Underground	23	0	5,179	0	0	0	100.000
Steam Heat	24	0	4,760	0	0	0	100.000
Transportation	18	0	3,460	0	0	0	100.000
Fourth Street	15	0	3,110	0	0	0	100.000
Stores	18	0	3,069	0	0	0	100.000
Street Lighting	13	0	2,990	0	0	0	100.000
Line	87	1	18,683	0	18	18	99.904
Meter	43	1	8,936	0	19	19	99.787
Gas	160	1	29,426	0	71	71	99.759
Millers Ford	91	0	19,407	234	0	234	98.794
Totals	581	3	117,375	234	108	342	99.853



NEW DESIGN OF SPILLWAY GATE WITH FIXED CENTER OF GRAVITY

Butterfly Spillway Gates at Exchequer Plant

IN DESIGNING the Exchequer dam of the Merced (Cal.) irrigation district the section of the dam at the crest was such that the ordinary types of spillway gates possessed certain disadvantages. To meet the particular requirements of the job an original design of butterfly type gate was developed. The gates at one end of the dam are shown in the accompanying illustration.

At each end of the dam there is a spillway section with seven water passages, each controlled by a butterfly-type gate. The gates are made up of steel trusses covered with steel plate and are 3x14x24 ft. The gates are rotated in a horizontal plane through 9 deg. by a 20-hp. operating mechanism that moves along a track on the crest of the dam. Two of these operating cars were provided, one for use at each end of the dam.

The group of gates at each end of the dam have a spilling capacity of 37,500 sec.-ft., or a total of 75,000 sec.-ft., or more than twice the greatest flood on record. Had any of the ordinary types of spillway gate been used, it would have been necessary to strengthen the section of the dam at the lip on account of displacement of the center of gravity with different positions of the gates.

Foreign and Domestic Meters Compared

A STUDY of some of the representative foreign makes of meters made by the committee on metering and service methods of the Association of Edison Illuminating Companies for the purpose of determining their suitability for American use has recently been made available through the N.E.L.A. meter committee serial report of November, 1926. This investigation involved their cost, availability, ability to meet American conditions and American standards of performance

Partial List of Tests Made in Comparing Foreign with Domestic Meters

	Code Number		Description	Foreign Meters																	
	Test	Item		1	2	3*			4			5			6			7		
						Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Initial accuracy curve—deviation from 100 per cent	1	1	Volts to creep—per cent rating	136†	136†	127†	.....	.....	127†	.....	.....	127†	.....	.....	127†	.....	.....	127†	.....	.....
		2	Watts to run—per cent normal	0.3	0.2	0.8	0.5	0.7	0.5	0.2	0.2	0.2	0.2	0.2	0.5	0.4	0.5	0.3	0.2	0.2
		3	5 per cent watts	+2.7	—1.5	—2.0	—0.6	1.5	+0.1	+0.8	0.3	+1.1	—0.3	0.7	—2.0	—1.0	1.1	—1.1	—0.1	1.1
		4	10 per cent watts	—0.2	—2.7	—1.4	+0.5	0.8	—1.5	—0.6	1.0	—1.4	—1.4	1.3	—0.8	—0.5	0.6	—1.4	—0.1	0.5
		5	20 per cent watts	—0.8	—0.6	—0.2	+0.6	0.8	—1.7	—0.6	1.1	—1.0	—1.9	1.5	—1.1	+0.2	0.5	—0.9	—0.2	0.6
		6	50 per cent watts	+1.0	+1.5	+1.3	+1.7	1.7	0	+0.3	0.3	—0.2	—0.1	0.3	—1.0	0	0.4	—0.5	+0.5	0.4
		7	100 per cent watts	0	+1.5	+1.0	+1.2	1.4	0	+0.5	0.3	+0.8	0	0.3	—0.3	—0.3	0.3	—0.2	0	0.4
		8	150 per cent watts	—3.8	—0.2	—0.3	—0.5	1.0	—0.8	—0.2	0.4	+0.3	—0.4	0.4	—0.6	0	0.3	—1.0	—1.0	1.2
		—	200 per cent watts	—8.7	—3.5	—1.5	—3.7	3.0	—2.4	—1.8	2.2	—2.2	—2.4	2.5	—2.6	—1.5	2.0	—3.2	—1.9	2.6
		—	300 per cent watts	—22.0	—13.5	—12.4	—11.8	11.5	—7.1	—5.6	6.4	—9.0	—9.2	9.2	—8.0	—6.4	7.1	—9.3	—7.3	7.9
			400 per cent watts	—37.3	—25.5	—21.9	—19.2	20.6	—12.3	—9.1	10.4	—19.6	—17.5	18.5	—13.0	—13.6	13.4	—15.0	—12.7	14.2
		9	Difference in register 10 and 100 per cent watts	0.2	4.2	2.4	0.7	1.6	1.5	1.1	0.3	2.2	1.4	1.6	0.5	0.8	0.5	1.2	0.1	0.5
Variation with power-factor—deviation from standard condition, per cent	2	1	10 per cent watts—75 per cent lag P.F.	+1.6	.....	—0.8	0	0.5	+0.9	+0.6	0.7	+2.0	+2.0	1.3	—1.8	—0.2	0.6	—0.2	0	0.4
		2	10 per cent watts—50 per cent lag P.F.	+2.1	.....	—0.5	—0.5	0.6	—0.3	+0.5	0.5	+4.6	+1.7	3.4	—2.5	—0.4	1.0	+3.0	—0.2	0.9
		3	100 per cent amps.—75 per cent lag P.F.	+1.7	.....	—0.7	—0.3	0.3	+1.2	+0.8	1.0	+2.1	+0.5	1.7	—0.2	0	0.2	+1.1	—0.1	0.7
		4	100 per cent amps.—50 per cent lag P.F.	—0.1	.....	—0.5	—0.1	0.3	+2.8	+1.3	1.7	+5.7	+2.8	3.5	—0.6	—0.1	0.5	+2.7	+0.2	1.1
Variation with voltage—deviation from standard condition, per cent	3	1	10 per cent watts—90 per cent volts	—1.0	.....	—1.1	—0.1	0.6	+0.3	+0.4	0.4	+0.1	+0.3	0.2	—1.3	—0.2	1.2	—0.4	—1.2	0.8
		3	10 per cent watts—110 per cent volts	+0.9	.....	+0.7	+0.4	0.7	—0.4	—0.1	0.3	+0.3	0	0.2	+2.1	+1.4	1.5	+1.0	0	0.8
		2	100 per cent amps.—90 per cent volts	0	.....	+0.5	+0.4	0.4	+0.7	+0.6	0.5	+0.6	+0.4	0.4	—0.1	0	0.1	+0.6	0	0.4
		4	100 per cent amps.—110 per cent volts	—1.2	.....	—0.7	—0.1	0.3	—0.7	—0.5	0.6	—0.3	—0.4	0.4	+0.3	+0.1	0.1	—1.3	—0.1	0.3
Variation with frequency—deviation from standard condition, per cent	4	1	10 per cent watts—95 per c't frequency	+1.5	.....	+0.2	+0.3	0.5	+0.1	+0.2	0.2	—0.1	+0.2	0.2	+1.4	+1.2	1.5	—0.9	—0.3	0.4
		3	10 per cent watts—105 per c't frequency	+1.3	.....	—0.7	+0.5	0.5	—0.2	—0.2	0.2	0	+0.1	0.1	—1.0	—1.2	0.8	—1.0	—0.1	0.6
		2	100 per cent watts— 95 per c't frequency	—1.6	.....	—1.1	—0.3	0.6	+0.2	+0.2	0.3	—0.1	—0.2	0.2	+1.7	+0.5	1.0	+0.6	—0.3	0.5
		4	100 per cent watts— 105 per c't frequency	—0.9	.....	—0.4	—0.4	0.5	—0.9	0	0.3	+0.8	+0.1	0.4	—0.5	—0.4	0.6	—1.1	—0.6	0.7
Effect of stray fields—deviation from standard condition, per cent	6	1	Conductor horizontal and behind meter	0.3	.....	0.2	.....	.....	0.1	.....	.....	0.8	.....	.....	0.4	.....	.....	0.4	.....	.....
		2	Conductor vertical and behind meter	0.1	.....	0.4	.....	.....	0.2	.....	.....	0.8	.....	.....	1.6	.....	.....	0.2	.....	.....
		3	Conductor vertical and beside meter	0.5	.....	0.1	.....	.....	0.2	.....	.....	0.9	.....	.....	1.5	.....	.....	0.1	.....	.....
Variation with temperature—per cent per deg. C.	7	—	10 per cent load	+0.15	.....	+0.14	+0.09	+0.12	+0.08	+0.05	+0.06	+0.08	+0.07	+0.07	+0.17	+0.13	+0.14	+0.09	+0.04	+0.07
			100 per cent load	+0.16	.....	+0.18	+0.13	+0.15	+0.07	+0.05	+0.07	+0.08	+0.08	+0.08	+0.16	+0.14	+0.15	+0.09	+0.09	+0.09
Effect of temporary overloads—deviation from standard condition, per cent	8	1	10 per cent load	+1.2	.....	—0.8	+0.2	—0.1	—0.5	—0.3	—0.3	—0.8	0	—0.4	—0.7	—0.4	—0.5	—0.9	—0.4	—0.5
		2	100 per cent load	+0.5	.....	+0.2	+0.2	+0.2	—0.1	0	—0.1	—0.3	+0.1	—0.1	+0.3	+0.1	+0.1	—0.3	—0.2	0
Mean arithmetic deviation in normal accuracy tests, per cent	10	1	10 per cent load	0.5	.....	3.9	0.1	0.8	0.2	0.1	0.1	0.3	0.2	0.2	0.6	0.2	0.4	0.7	0.1	0.3
		2	100 per cent load	0.1	.....	0.4	0.2	0.3	0.1	0.1	0.1	0.2	0	0.1	0.1	0	0.1	0.4	0.2	0.3
Torque weight ratio millimeters and grams		—	Full load torque	55.8	31.4	61.9	59.4	60.9	48.4	43.4	45.4	35.8	32.0	34.2	55.6	49.3	52.2	31.5	29.9	30.8
		—	Weight	28.0	16.0	29.6	29.1	29.4	27.4	26.8	26.9	13.7	13.5	13.7	27.9	28.0	28.0	15.8	15.4	15.6
		—	Ratio	1.99	1.95	2.09	2.04	2.07	1.77	1.63	1.69	2.61	2.37	2.50	1.92	1.76	1.84	2.00	1.94	1.97

	Code Number		Description	Domestic Meters																
	Test	Item		1			2			3			4			5			6		
				Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Initial accuracy curve—deviation from 100 per cent	1	1	Volts to creep—per cent rating	127†	.....	.....	127†	.....	.....	127†	.....	.....	127†	.....	.....	127†	.....	.....	136†	.....	.....
		2	Watts to run—per cent normal	0.4	0.2	0.3	0.5	0.5	0.5	0.3	0.3	0.3	0.7	0.4	0.5	0.3	0.2	0.3	0.2	0.2	0.2
		3	5 per cent watts	+2.0	+1.0	1.5	+0.3	—0.3	—0.3	+2.3	+2.3	2.1	+2.9	+1.9	2.4	—1.6	+1.1	1.1	+0.7	—0.2	0.4
		4	10 per cent watts	+0.6	+0.7	0.7	—0.8	—0.7	0.8	+0.3	+0.2	0.2	0	+0.2	0.1	—0.7	+0.9	0.8	+0.7	+0.3	0.6
		5	20 per cent watts	—0.4	+1.2	0.5	—1.2	—0.7	0.8	—0.3	—0.3	0.3	+0.7	+0.4	0.5	+0.1	+0.8	0.4	+0.7	+0.3	0.6
		6	50 per cent watts	—0.2	+1.1	0.5	—0.2	+0.4	0.6	0	0	0.1	+0.2	+0.4	0.4	+0.9	+1.3	1.1	+0.6	+0.4	0.6
		7	100 per cent watts	—0.5	+0.9	0.5	—0.3	+0.4	0.6	—0.1	—0.2	0.1	+0.3	0	0.2	+0.9	+1.2	0.9	+0.3	+0.2	0.3
		8	150 per cent watts	—1.2	0	0.8	—1.2	—0.1	0.6	—1.2	—1.2	1.2	—0.3	—0.7	0.5	—0.4	0	0.3	—0.3	—0.3	0.2
		—	200 per cent watts	—2.8	—1.5	2.3	—2.1	—1.5	1.6	—3.3	—3.3	3.3	—1.7	—1.2	1.4	—2.5	—2.2	2.4	—1.3	—1.5	1.1
		—	300 per cent watts	—6.5	—4.9	5.9	—7.0	—6.2	6.5	—10.7	—10.2	10.6	—7.0	—5.1	5.7	—9.3	—8.0	8.7	—3.4	—3.6	3.2
			400 per cent watts	—12.6	—9.5	11.3	—12.3	—10.7	11.5	—18.6	—18.6	18.6	—15.5	—13.0	14.2	—17.4	—15.8	16.4	—8.3	—7.3	—7.7
		9	Difference in register 10 and 100 per cent watts	1.1	0.2	0.7	0.5	1.1	1.1	0.4	0.4	0.4	0.3	0.2	0.2	1.6	0.3	0.9	0.4	0.1	0.2
Torque weight ratio millimeters and grams *		—	Full load torque	30.6	28.2	29.6	48.4	42.1	45.7	46.6	46.3	46.4	42.8	36.0	38.5	43.4	38.1	40.3	35.1	33.6	34.1
		—	Weight	11.5	11.5	11.5	13.0	12.8	13.0	15.6	15.7	15.7	12.4	12.4	12.5	15.7	15.5	15.3	16.8	17.1	16.8
		—	Ratio	2.66	2.46	2.56	3.71	3.28	3.49	2.98	2.94	2.96	3.44	2.90	3.08	2.76	2.46	2.57	2.09	1.97	2.01

*Ten meters submitted, but one performed so badly in initial accuracy tests that the full list of tests was not made and the results of tests made have been omitted.
†Results above values shown, but tests were not carried far enough to obtain exact amount.

and was intended to provide a proper basis for comparison with the operating characteristics and general serviceability of the American-made product.

In analyzing and reporting the results the committee included a discussion of other factors involved in the production and transporting of meters to this country and, finally, a discussion of the prices at which they might be expected to be sold in this country as compared with the domestic products. In the opinion of the committee it seemed sufficient to confine the investigation to the most commonly used house size meters of 5-amp., 110-volt, two-wire capacity, inasmuch as this size of meter represents probably 85 per cent of the purchases of the utilities.

In general it was found that the high-grade European meters were comparable with American meters in performance—at least on initial trial. Their continuing performance in service is reported more doubtful. Their ratio of torque to weight of moving elements, which is considered vital for continued accuracy, is comparatively low. Their overload accuracies, a characteristic now becoming quite important for residence meters, is not so good as in American meters. Changes in accuracy under varying voltage, frequency, temperature, power factor, etc., are greater. In mechanical construction they appear inferior to the American product, according to the report of the committee.

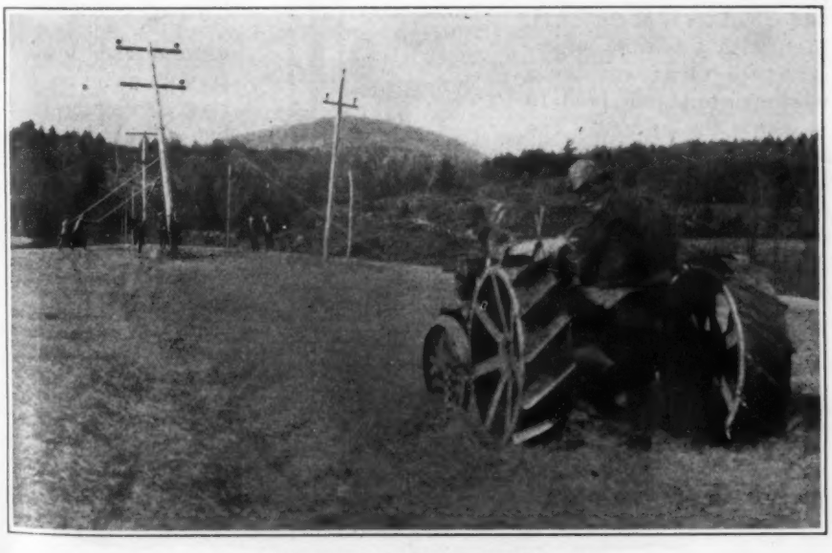
The table on page 102 indicates in a general way the relative performance of the meters tested. The column headed "Max." shows a maximum deviation or highest value observed of any one meter in one particular group of tests, whereas the column headed "Min." shows the minimum deviation or lowest value of any one meter in that same group of tests. In other words, the figures in a given column do not necessarily show the performance of the same meter in all tests. The "Avg." column gives the arithmetic average deviation in accuracy tests and true average values in the special test.

*Ten meters submitted, but one performed so badly in initial accuracy tests that the full list of tests was not made and the results of tests made have been omitted.
†Results above values shown, but tests were not carried far enough to obtain exact amount.

Tractor and Winch Help Vermont Line Erection

A TRACTOR equipped on the front drum with a two-drum winch has enabled the Vermont Hydroelectric Corporation to raise and set about twenty poles per day complete with crossarms, hardware and insulators on the new 25-mile Clarendon-Cavendish line. Pike poles are used for steadying only. The new line is constructed with 40-ft. Western red cedar Class B poles with ½-in. guaranteed penetration. The conductor spacing is for 66 kv., but the insulators for present operation are 44 kv. On this job additional right-of-way was purchased so that the new line could be built 20 ft. away from an older line without interrupting service. The triangular construction of the old line is being superseded in the new line by the use of double crossarms, space being provided for the installation of a second circuit through the addition of a third arm.

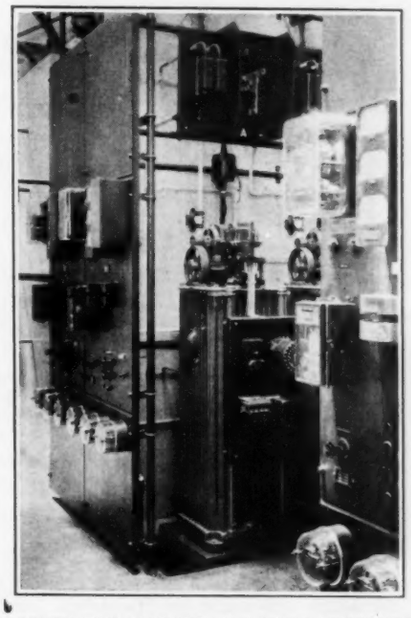
The use of the tractor in this work saves time in the rough country despite the fact that other types of equipment might be quicker and better adapted to line erection in more favorable terrain.



TRACTOR EMPLOYED IN ERECTING POLES

Pit Beneath Regulators to Catch Oil

ONE of the safety precautions taken by the Pacific Gas & Electric Company in designing its Hayward automatic substation was to place the three 4-kv. feeder voltage regulators over a concrete pit to catch the oil in case a regulator tank should break. One end of this pit may be seen in the accompanying illustration. It is 8 in. deep, 25 in. wide and 9 ft. long and will hold 45 gal. of oil, or considerably more than the amount of oil contained in one regulator. No drain has been provided, as this is considered unnecessary.



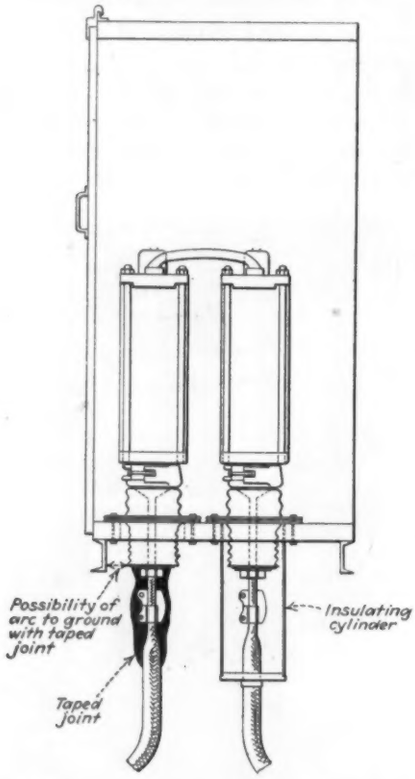
FEEDER REGULATORS SET OVER CONCRETE PIT TO CATCH OIL

Arc-to-Ground Protection on Circuit Breakers

BY WALTER T. FREY
Electrical Maintenance Foreman Sherman Creek Station, the United Electric Light & Power Company, New York City

IN AN installation of 13,200-volt oil circuit breakers at the Sherman Creek station of the United Electric Light & Power Company it was found inconvenient to apply adequate taping between the cable connections and the pot-holder studs. Owing to the uneven surface over which the tape had to be applied and because the last lap ended against

the pot-holder insulator, a seam was left between the pot-holder insulator and its stud washer, presenting an exposed surface through which an arc to ground might flash in case of an abnormal surge voltage due to feeder failure.



INSULATING CYLINDERS OVER CIRCUIT BREAKER CONNECTIONS PREVENT ARC TO GROUND POSSIBLE WITH ORDINARY TAPED CONNECTION

The difficulty of taping was overcome by fitting insulating cylinders (18 in. long with ¼-in. wall) over the pot-holder insulator; the cylinder is molded out of a high-insulating compound. Maple-wood disks, 1 in. thick with a step cut into them to fit into the cylinders were likewise designed. Holes were drilled into the centers of these wooden disks to clear the insulation of the cables, the diameter depending on the size of the cables.

The disk and cylinder are slipped over the cable, which is then connected to the pot-holder stud, and the cylinder is pushed up into the breaker-cell base, covering the lower half of the pot-holder insulator, stud and part of the cable. The cylinder is held in place by a piece of friction tape wrapped around the cable under the wooden disk.

The cylinders save the cost of taping where feeder location changes from time to time, and since their installation there has been no trouble from flashovers.

Lynn Utility Adopts Electric Tower Wagon

BY J. A. COOK
Superintendent Electrical Department
Lynn Gas & Electric Company

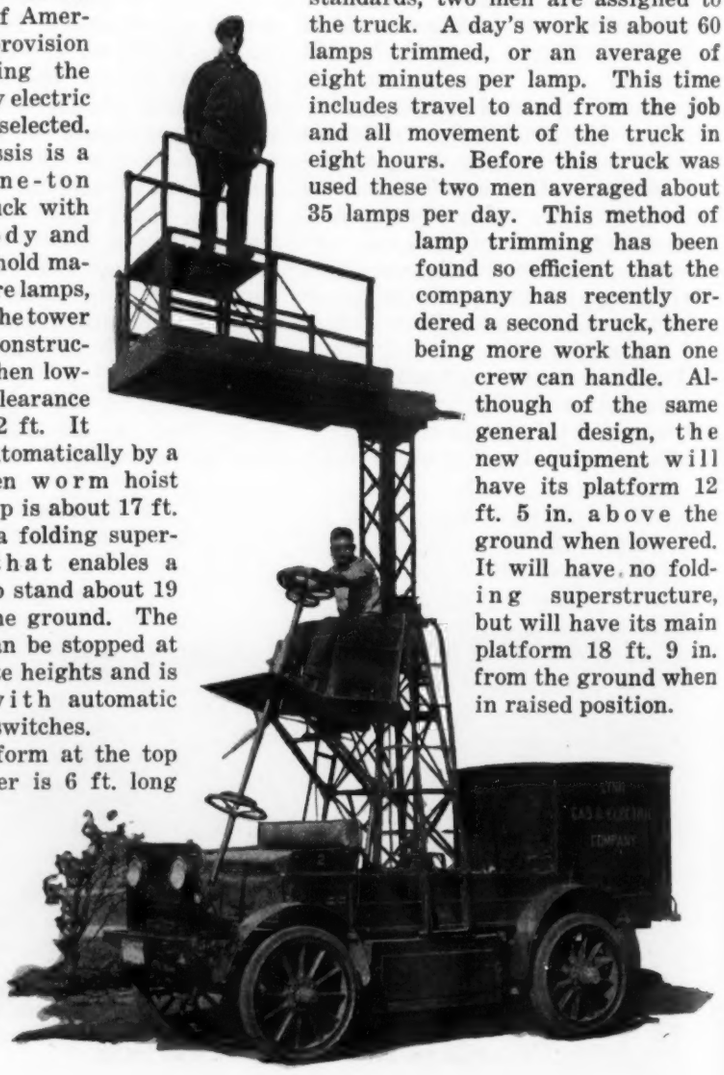
A SPECIALLY designed tower wagon has been used for some months by the Lynn Gas & Electric Company in the care of street-lighting service throughout the 26.5 square miles of territory covered by its lines. On June 10, 1926, the company supplied service to 767 street lamps, of which 268 were 6.6-amp. luminous arcs of the ornamental type and the remainder series incandescents. The former were installed with light centers 19 and 22 ft. above ground and the latter 16 to 32 ft. Prior to 1926 a horse-drawn wooden tower wagon was used in trimming, but this was inadequate to reach lamps more than 18 ft. above the street. The platform was elevated by hand and was inflexible and slow in service. To handle this work more conveniently a truck built by the Commercial Truck Company of America, with provision for elevating the platform by electric motor, was selected.

The chassis is a standard one-ton electric truck with express body and cabinet to hold materials, spare lamps, tools, etc. The tower is of steel construction and when lowered has a clearance of about 12 ft. It is raised automatically by a motor-driven worm hoist and when up is about 17 ft. high with a folding superstructure that enables a workman to stand about 19 ft. above the ground. The platform can be stopped at intermediate heights and is equipped with automatic stop limit switches.

The platform at the top of the tower is 6 ft. long and is mounted on a turntable, which facilitates swinging the tower over gutters and other obstacles to reach the lamp when it is necessary to stop the truck several feet away. A second steering wheel and controls are provided about 8 ft. above the ground so that the operator can shift the truck without climbing down.

The truck is easy to handle, as the raising and lowering of the tower are automatic, the platform shift is rapid and convenient and the extra set of controls saves much time. Due to the adjustability of the platform obstacles do not have to be removed from the neighborhood of a pole. No gasoline motor has to be left running to furnish power for the tower, and the storage battery can be used on emergency jobs such as lighting and drilling.

In a typical day's work the truck covered 36 miles and trimmed 55 lamps, besides doing temporary pumping and lighting during the 24 hours. Due to the lamps being fairly close together, with many on twin standards, two men are assigned to the truck. A day's work is about 60 lamps trimmed, or an average of eight minutes per lamp. This time includes travel to and from the job and all movement of the truck in eight hours. Before this truck was used these two men averaged about 35 lamps per day. This method of lamp trimming has been found so efficient that the company has recently ordered a second truck, there being more work than one crew can handle. Although of the same general design, the new equipment will have its platform 12 ft. 5 in. above the ground when lowered. It will have no folding superstructure, but will have its main platform 18 ft. 9 in. from the ground when in raised position.



ELECTRIC TOWER TRUCK SPEEDS UP LAMP TRIMMING 70 PER CENT

Commercial Activities and Public Relations

Utility Employees Give First Aid to Public

BY W. E. RICHMOND
San Diego Consolidated Gas & Electric Company, San Diego, Cal.

DURING the past few years, in which automobile accidents have become an every-day occurrence on streets and highways, crews of the San Diego Consolidated Gas & Electric Company many times have been of great assistance in rendering first aid to the public. The company regards it as part of its duty to the public to render such assistance and also realizes that in so doing it is gaining public good will through its humanitarian acts.

All automobile trucks operated by the company are provided with first-aid kits and crews are thoroughly schooled in rendering first aid. This phase of the company's safety work is under the direction of a first-aid officer, who trains men, inspects kits, issues instructions, etc.

Electric Heat in the Fruit Industry

TWO recent applications of electric heat in the fruit industry have been made in the West; one in coloring lemons and oranges, and the other in drying dates.

The many warehouses that pack lemons and oranges are fast installing electric heaters for use in connection with the coloring of these fruits with ethylene gas. The fruit is packed in small boxes and placed in the various "sweat" rooms. These rooms are usually about 15 ft. cubes and are so arranged that the air circulates through and between the various boxes. A few feet of the gas is released into each room, this gas being heated by electricity and the temperature automatically controlled. In this application an inclosed heater has been found desirable to eliminate the possibility of short circuiting because, although ethylene gas is not dangerously explosive, it might cause fire under some conditions. By this method fruit can be picked early and uniformly colored at the warehouse, eliminating the long delay of coloring fruit on the trees.

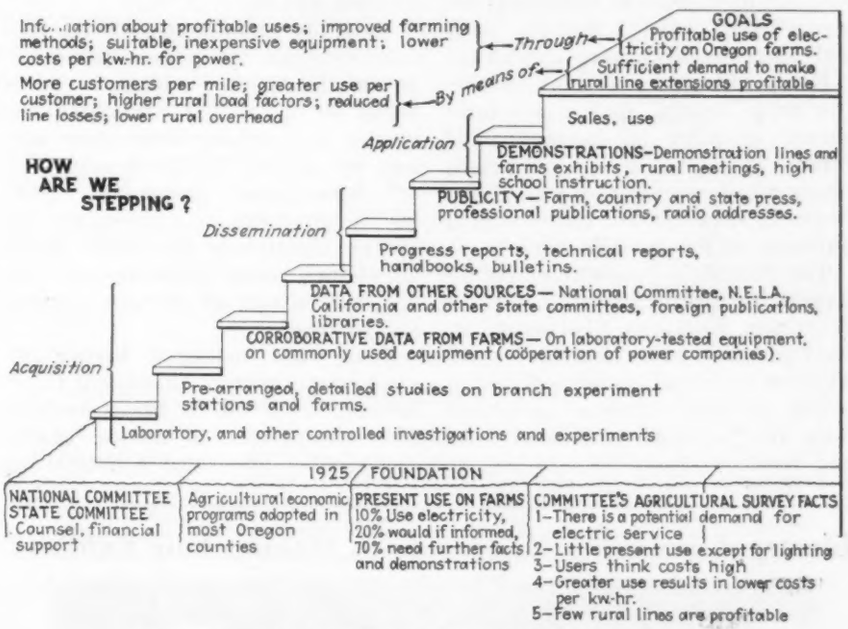
The use of electricity in the date-packing industry has improved the product and made possible the use of dates that would otherwise be inedible. A new packing house was recently built in Alhambra, Cal., owned and operated by the Date Corporation of America. This packing house uses electric heating units in drying the dates. After the fruit is picked it absorbs moisture, and by the time it reaches the packing house it is in such a condition that some of the moisture must be removed before packing. This is accomplished by placing truckloads of fruit packed on trays in a number of small rooms into which electrically heated air is blown and in which a small air pressure is maintained to give the same conditions of air circulation in each room. The temperature of the air is controlled by means of a thermostat.

This drier proved itself of particular value in the past year because of late rains that threatened the entire crop. At the packing house, however, the dates were put through the drier and the greater amount of the crop was saved by this method of removing the moisture from them.

Although the installation is in actual use but two months of the year, it is maintained throughout the entire year as a precaution against similar cases of late rains.

Oregon Rural Committee Graphs Procedure

AN INTERESTING diagrammatic plan of procedure which the Oregon Committee on the Relation of Electricity to Agriculture is endeavoring to follow is presented in its 1926 annual report. The chart is presented for two purposes: (1) To suggest the steps by which it may arrive at its goal of profitable use of electricity on Oregon farms, and (2) to aid in mapping out the future activities of the state organization.


Information about profitable uses; improved farming methods; suitable, inexpensive equipment; lower costs per kw-hr. for power.
Through
GOALS
Profitable use of electricity on Oregon farms.
More customers per mile; greater use per customer; higher rural load factors; reduced line losses; lower rural overhead
By means of
Sufficient demand to make rural line extensions profitable
Application
Sales, use
DEMONSTRATIONS—Demonstration lines and farms exhibits, rural meetings, high school instruction.
HOW ARE WE STEPPING?
PUBLICITY—Farm, country and state press, professional publications, radio addresses.
Dissemination
Progress reports, technical reports, handbooks, bulletins.
DATA FROM OTHER SOURCES—National Committee, N.E.L.A., California and other state committees, foreign publications, libraries.
CORROBORATIVE DATA FROM FARMS—On laboratory-tested equipment, on commonly used equipment (coöperation of power companies).
Acquisition
Pre-arranged, detailed studies on branch experiment stations and farms.
Laboratory, and other controlled investigations and experiments
1925 FOUNDATION
NATIONAL COMMITTEE
STATE COMMITTEE
Counsel, financial support
Agricultural economic programs adapted in most Oregon counties
PRESENT USE ON FARMS
10% Use electricity,
20% would if informed,
70% need further facts and demonstrations
COMMITTEE'S AGRICULTURAL SURVEY FACTS
1—There is a potential demand for electric service
2—Little present use except for lighting
3—Users think costs high
4—Greater use results in lower costs per kw-hr.
5—Few rural lines are profitable

STEPS IN RURAL ELECTRICAL INVESTIGATIONS BEFORE GOAL CAN BE REACHED (OREGON)

There is a place part way up the "stairs" where it is expected investigational work will give way to disseminating information through reports, publicity and demonstrations. From this time on the committee expects to do some of both types of work. In order to make its study effective, the information obtained will be conveyed to those who will make use of it. Meanwhile the search for further facts continues.

Assuming that profitable farm uses will eventually be developed in sufficient number to warrant line extensions, there will be another place

on the "stairs" where educational work and sales will merge. It is at this point that the work of the committee is expected logically to end and that of the public utility and equipment companies to carry on.

Purchased Power in a Furniture Factory

Wood Waste Available Is Insufficient to Fuel Isolated Plant—Steam Load Not Co-ordinated with Electrical Load—Advantages of Central-Station Power

BY W. H. SNYDER
Industrial Power Department, Wisconsin Power & Light Company

WOOD WORKING is one of the large industries in Wisconsin that are being benefited by the rapid development of electric-driven machinery, and many plants are replacing the old belt-driven equipment with the more efficient individual and group-drive planers, shapers, saws and other wood-working appliances.

Every change in a plant to electric drive brings up the much-discussed question of isolated plant versus purchased power, especially where wood waste is available and steam is required for heating large buildings or for dry-kiln work.

The Northfield Company, one of the largest furniture manufacturers in Wisconsin, located in Sheboygan, attests the value of an electrified wood-working plant and purchased power.

The present equipment is practically 100 per cent individual drive and consists of machines in the upholstering department driven by a ¼-hp. motor on the lighting circuit up to large surfacers with five motors on each machine, totaling 40 hp. The total motor load of the plant consists of approximately 83 motors totaling 440 hp.

Until the summer of 1926 the motors were all two-phase, 220 volts, but at the time of adding an additional 40 hp. it was considered advisable to purchase three-phase motors on account of the development of three-phase equipment. This led to conversion to three-phase operation throughout the entire plant, all motors being either rewound or reconnected and all circuits changed and balanced.

This plant consumes during the year approximately 12,000,000 ft. of lumber, 7,000,000 ft. being used in the manufacture of tables, chairs and similar lines, and 5,000,000 ft. for crating. The waste, which is mostly hard wood, is burned in the plant furnaces or sold locally. It is impossible to state the amount of sawdust and shavings consumed, as this refuse is blown direct into the boilers. Other wood waste consumed by the plant boilers amounts to approximately 16,000 lb., or eight tons, per month, or a coal equivalent of three and one-half tons. The waste that is sold (the larger pieces) amounts to fifteen tons per month and brings in a monthly revenue of approximately $120. None of the wood waste consumed in the plant is hogged.

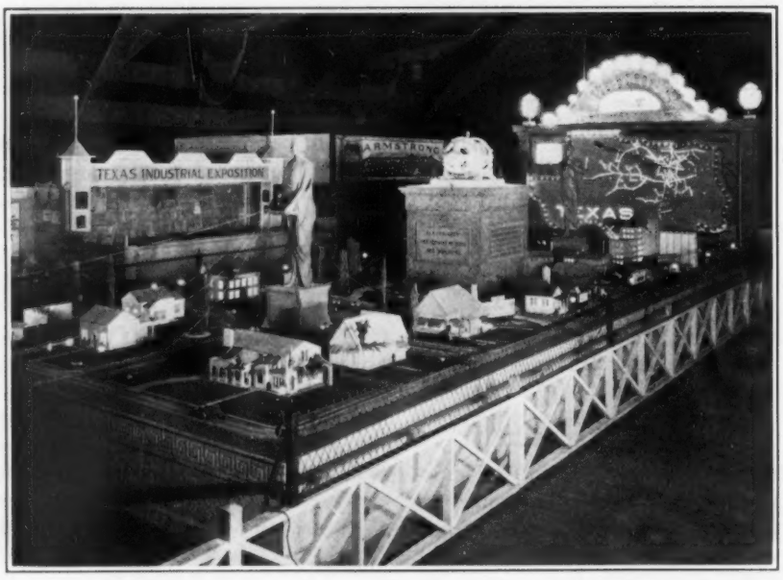
During the past year this factory consumed for heating and other steam purposes 613 tons of coal at an estimated cost of $255 per month in addition to the wood waste. The consumption of coal by months is as follows: January, 101 tons; February, 103; March, 92; April, 57; May, 39; June, 15; July, none; August, none; September, 10; October, 31; November, 75; December, 90 tons. On account of the repairs to the heating system the consumption of coal for the next year is estimated to be not in excess of 550 tons. Steam is generated at 90 lb. and reduced to 5 lb. for the heating system, the dry kilns and for heating and mixing glue.

It can be observed from the preceding figures that a plant of this size and nature is producing slightly more than enough wood to take care of the dry-kiln requirements, since no coal is used in the summer months.

Although the Northfield Company could use exhaust steam for heating and kiln work, G. A. Strassberger, secretary and treasurer, states that the company is thoroughly satisfied with the economies of electric drive and of purchased power, due to better operation, better and faster production and a safer and more efficient plant. This statement from a wood-working concern is welcomed by utility companies, as this type of plant, with wood waste to burn and steam requirements, has always been more or less of a stumbling block to the power salesman. Here, however, is an example of electrification and purchased power backed by years of experience in a modern and growing plant.

On account of the varied products it is difficult to obtain figures of electric consumption per unit, but in the past year an average of 19,200 kw.-hr. was consumed monthly with a maximum fifteen-minute demand of 100 kw.

Electric Companies Co-operate in Making Fair Exhibits



FOR the first time since the introduction of electricity in Texas, six nationally recognized companies recently joined in making a single but comprehensive exhibit, constructed to tell in the simplest terms what electric service means to progress, according to C. J. Rutland, safety engineer Texas Power & Light Company. The exhibit was made at the State Fair of Texas, held recently at Dallas. The six organizations co-operating were: Texas Power & Light Company, the Southwest General Electric Company, the Graybar Electric Company, Westinghouse Electric & Manufacturing Company, the General Electric Company and the Dallas Power & Light Company.

Refrigeration Records and Service Data

NEXT to the proper installation of electric refrigerators, servicing and inspection are of utmost importance to utilities and other dealers. Many companies, to develop this business and impress upon customers the desirability of electric refrigeration, have adopted extremely liberal policies in regard to free service. As a promotional measure this has much to recommend it, but the survey of electric refrigeration published in the ELECTRICAL WORLD recently indicated that few companies and dealers are keeping any systematic or reliable records of the number and cost of service or inspection calls. Some companies have, however, set up comparatively simple card systems whereby they can keep accurate records of the nature of complaints, number of service calls and costs.

Several typical inspection and service record cards are reproduced here showing the kind of data that electric refrigeration sales and service departments are finding most useful in classifying complaints and analyzing costs. With this information available it is possible for the head of the refrigeration department to draw up monthly or quarterly analyses of refrigeration servicing and quickly spot any common weakness in the machine or method of installation which is causing trouble.

Inspection after installation has been found to be the best preventive of subsequent complaints. The result of this inspection routine has been to insure careful work by the crew that installed the unit and it has virtually eliminated complaints.

Experience has indicated that defects in material, construction, design and installation can best be detected and appraised by studying actual operating performance of units in customers' homes and that these data can be gathered only if individual dealers will keep records.

RECORDS OF ELECTRIC REFRIGERATOR SERVICE CALLS AND COSTS

A

Name of User				Home Address							
Make of Machine		Size		Type		Serial					
Complete Unit				Where located							
Date of Installation				Installed By							
Terms of Sale											
SERVICE CALLS											
			Nature of Complaint								
Dates	Time Spent	Expense	Thermostat	Belt	Expansion Valve	Idler Pulley	Compressor	Motor	Water Trouble	Condenser	Miscellaneous

B

1.26.3m

Company

Unit

REFRIGERATION RECORD AND SERVICE DATA

Date of Sale

Salesman

Address

Consumer

Serial No.

Location Unit

Motor No.

Motor Mfgr.

C

DELCO LIGHT CO.

INSPECTION

DATE FIRST

DATE SECOND

NAME

ADDRESS

	First	Second
What is high temperature in box?		
What is low temperature in box?		
Does unit sit solid on feet?		
Are check nuts on adjustable feet?		
Does compressor unit swing freely on rings?		
Is compressor unit level?		

D

8.26 5m

TROUBLE REPORT

Received

Customer's Name

Address Phone

Model No. Serial No.

Motor

Complaint:

Assigned

Nature of Trouble and Remedy

Completed

Service Man.

Total Material Charge		
Labor—Hours at per Hr.		
Customer's Signature	Total Chg.	

A and B—Two forms of record cards used to keep history of each individual installation. The items listed on B are: Salesman, date of sale, consumer, address, location of unit, serial number, motor manufacturer, motor number, type of condenser, drive, model, cooling unit, make of refrigerator, total cubic feet, ice compartment width, depth, height, condition, in use, installed by, date, meter installed and date.

C—Inspection card to check new installations. The items listed for checking are: What is high temperature in box; what is low temperature in box; does unit sit solid on feet; are check nuts on adjustable feet; does compressor unit swing freely on rings; is compressor unit level; does motor run counter-clockwise; check oil in gear case; check oil in motor bearings; remove vent plug in gear case; does pulley on motor line with flywheel; has belt proper working tension; what is cut-in gage pressure in pounds; what is cut-out gage vacuum in inches; does flapper valve hold vacuum; what is cut-out gage pressure, safety side; adjust automatic water valve to open at 50 deg. F.; does automatic water valve close tight; clean automatic water valve line strainer; are high-pressure valves open at compressor; is low-pressure valve properly adjusted; is water valve in house line open; are packing nuts tight at valves; does compressor unit run quietly; check operation of switch; stop switch weight noises; do noises telegraph in building; what size fuses in electric line; inspect electric installation; is suction line clear of frost; has suction line downward slope to compressor; are SO_2 lines free from pockets and kinks; are SO_2 lines properly fastened; are SO_2 lines properly taped; is cooling unit in center of ice compartment; is top of cooling unit lower than air inlet; is bottom of cooling unit 1½ in. above drip shield; is cooling unit set level; is cooling unit set rigid; tighten screws in boiler head; tighten flare nuts at boiler head; are valves open at boiler head; are plugs litharged and tight at boiler; test for SO_2 leaks; is float valve quiet; is drip-line properly installed; is trap in drip-line filled with water; is hole in box plugged with hydrolene; do doors in box fit tight; is box properly baffled; what is general condition of box; is there any SO_2 odor in box; how often do they defrost; temperature of brine (deg. F.); density of brine, hydrometer; temperature in ice-cream cabinet sleeve.

D—Trouble report and work order covering each complaint. On back of this report is space to indicate quantity, part number, parts used, unit cost and total cost of repairs. Also for indicating inspection of frost condition on brine tank, water-valve setting, float-valve operation, motor oiling, high-pressure control and switch operation.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Small Steam Turbo-Generators.—J. BETHENOD.—Primarily to supply steam locomotives and trains with electric light, a standard line of steam-turbine-driven generators is described, with capacities of 0.5 kw., 1.5 kw. and 6.7 kw. The machines operate at relatively moderate speeds, 2,600 to 3,600 r.p.m., and have a very sensitive speed regulation. With superheated steam of 12 atmospheres pressure, the largest model has a steam consumption of 270 kg. per hour. The completely sealed electric generators have ample heat radiation to prevent overheating and their windings are chiefly mica-insulated. Grease-lubricated ball bearings reduce the attention necessary to a minimum.—*Bulletin de la Société Alsacienne*, October, 1926.

Control of Hydro-Electric Plants.—F. J. TAYLOR.—This article provides a general discussion of the practicability of constructing small hydro-electric plants as auxiliaries to the main plant. Automatic and remotely operated systems are described, and some attention is paid to the extensive protective arrangements which are necessary.—*Electrician (England)*, Dec. 3, 1926.

Generation, Control, Switching and Protection

Compound-Filled Switchgear.—This article provides some notes on the latest British Thomson-Houston designs in switchgear. In addition to the usual features of safety and reliability, it is said that the equipments are so designed that they can be operated by semi-skilled labor and extensions and alterations can be made with a minimum interruption of supply. Shutters automatically cover the live contact when the breaker is withdrawn, and these are so arranged that the busbar and circuit shutters can be separately or collectively padlocked.—*Electrician (England)*, Dec. 3, 1926.

Outdoor Switching Station. — J. SCHLÖGL.—At a point where the power lines from three generating stations join to enter Vienna on a double three-phase 110-kv. line an outdoor switching station has been erected. Six groups of oil switches, each comprising three single-phase breakers, permit various interconnections between incoming and outgoing lines. These single-pole switches are dimensioned for 400 amp. and 600,000 kva. rupturing capacity. They have six breaks per pole and are equipped with explosion chambers. They are installed in round steel tanks and weigh 7½ tons each. Of particular interest is a 2,600-kva., three-phase quenching transformer, which is connected to the buses to minimize dangers from overvoltages and "grounds." This unusually large machine is dimensioned for a maximum of five minutes of operation and weighs complete 25 tons. In the operating room are the controls for the oil switches and a storage battery for the required control current. A charging set receives its power from a 50-kva. auxiliary transformer, which is fed from a small local central station delivering 10,000-volt, three-phase current. In an emergency a Diesel-electric generating set can supply the demand of the station. Carrier-current telephonic communication with all interconnected plants is possible over power lines.—*Elektrotechnik und Maschinenbau*, Oct. 31, 1926.

Cooling Mercury-Arc Power Rectifiers.—O. SEITZ.—The mercury-arc power rectifier is a stationary converter, and since there are no mechanical rotating parts, the losses which cause heating are not carried away by natural ventilation as with rotating converters. The heat produced in the rectifier must be dispersed by artificial means, several of which are discussed with much detail in this article. Three general methods of cooling are discussed, their choice in commercial practice depending upon the direct-current pressure and the price, quality and pressure of the available cooling water. These methods are (1) direct cooling by a continuous supply of water, (2) indirect cooling by continuous supply of water, and (3) closed-circuit cooling with natural or forced draft.—*Brown Boveri Review*, December, 1926.

Units, Measurements and Instruments

Magnetostriction.—L. W. MCKEEHAN.—The principal periods of progress in magnetostriction have c'osely followed upon the invention of voltaic batteries capable of furnishing steady magnetizing current, upon the design and construction of galvanometers for measuring such current and the current induced by changes in magnetization, upon every advance in the precision of length measurement, and upon the development of a technique for the preparation and heat treatment of homogeneous ferromagnetic alloys. The author devotes attention in this paper to the history of the subject. Before proceeding to his discussion of a recent theory of a rather different sort from that outlined in the historical discussion of the material, he undertakes to clarify the view of the experimental material by arranging a convenient system for classifying all the phenomena that he believes should be covered by any competent theory. Detailed discussion follows of alloys, atomic magnetostriction, stresses, values of resistivity and mechanical properties of material stresses. The paper is amply illustrated with graphs of magnetization curves of material which has been tested. In concluding, the author observes that the growing interest in the study of magnetostriction bids fair to develop in a way to throw light on the obscure subject of interatomic forces in solids.—*Journal of Franklin Institute*, December, 1926.

Transmission, Substations and Distribution

Distribution System Practice of the Puget Sound Power & Light Company.—M. T. CRAWFORD.—This article describes the distribution system in the Seattle district, planned especially to take care of rapid expansion. Details are given of the company's plant and of its railway, Edison and light and power distribution substations, several of which have been recently constructed and are of the full-automatic semi-outdoor type, built according to the best modern practice. Some attention is given to the overhead residential distribution, to the suburban distribution and also to what is characterized as rural distribution.—*General Electric Review*, December, 1926.

Short-Circuit Currents in High-Tension Networks.—J. BIERMANNS.—This article is an excerpt from the author's treatise "Uberstrome in Hochspannungnetzen," published in Germany. It deals with the theoretical as well as practical considerations of short-circuit conditions in distributing networks. Inasmuch as the most usual current sources are synchronous machines, some attention is devoted to a discussion of the effect of suddenly short-circuiting the machines. In large modern machines the instantaneous short-circuit current, including the direct-current component, attains a value about eighteen times that of the full-load current, while the stable triple-pole short-circuit current at full-load excitation is about double the full-load current in turbo-generators and about four times the full-load current in machines with salient poles. The author discusses two general methods of calculating the short-circuit current in any network—one a mathematical procedure, outlined in detail, which, however, leads to extensive calculations for complicated networks. An approximate method requiring, even in the most complicated cases, only a relatively small amount of calculation and of sufficient practical accuracy is presented as an acceptable alternative. From specific examples given in the paper the author demonstrates that the normal error of the approximate method described lies within the limits of accuracy of the slide rule.—*A.E.G. Progress*, November, 1926.

Motors and Control

Locomotive Crane for Lifting 120 Tons. — E. ALTSCHUL. — The present article describes a very interesting crane train of the locomotive type which is installed in the Yverdon repair shops of the Swiss Federal Railway. It is used for moving the heaviest electric motors, as well as for lifting either small or heavy loads during erection. One of the chief requirements was for extremely smooth-starting and accurate speed regulations of the main gear. It was also specified that even if the load on the motors of the main crabs were different, the speed should not vary by more than 2 per cent in either direction. To satisfy these conditions and to enable the main winding gear to be electrically braked when lowering, Ward-

Leonard controls were chosen for the two main hoists. For the auxiliary crane, on the contrary, the usual reversing controls were provided, as the precision of control required in this case is not so great as that necessary for the main hoists. Technically, the crane consists of two halves, each of which is composed of one main girder and one auxiliary girder. The two halves of the bridge are secured to each other by strong frames which carry the rollers, and the design is such that the locomotive can be raised between the two main girders. This arrangement enables the locomotive to be lifted sufficiently high, even in spite of small total lifts, to clear other locomotives which may be in the way. All motions which are normally affected by electric motors can be carried out by hand if necessary, in the event of an interruption in the electric power supply. The mechanical and electrical parts are interlocked so that the hand control can be operated only if the drum of the electric controller affected happens to be in the neutral position.—*Brown Boveri Review*, December, 1926.

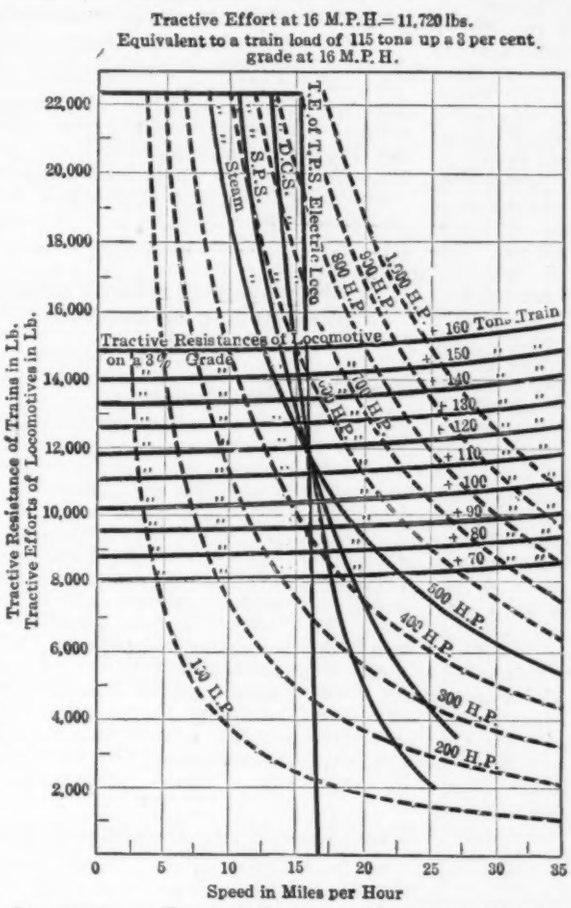
Electrophysics, Electrochemistry and Batteries

Electrochemical Reduction of Indigo.—JACOB NEVYAS and ALEXANDER LOWY.—A quantitative study has been made by the authors of the influence of variations in current density, temperature and concentration of electrolyte upon the current efficiency of the electrochemical reduction of indigo in finely divided suspension in solutions of sodium hydroxide, with a mercury cathode. It has been shown that the current efficiency decreases with increasing current density, increases with increasing temperature and increases with increasing concentration of alkali. An apparatus has been developed for studying electrochemical reductions which permits of the electrolysis of a compound and with the withdrawal of a sample of catholyte in an oxygen-free atmosphere.—*Paper which was presented before the American Electrochemical Society*, at Washington, D. C., October, 1926.

Photo-Electric Properties of Thin Films of Alkali Metal.—H. E. IVES.—This paper presents a study of the behavior with temperature of photo-electric and thermionic currents produced simultaneously from a thin film of caesium or platinum. A platinum ribbon in an atmosphere of caesium vapor is heated to various temperatures up to incandescence by the passage of an electric current. Keeping the vapor pressure of the caesium low by cooling the walls of the tube, thermionic currents and photo-electric currents, caused by illuminating the ribbon, are obtained of the same order of magnitude, and their variation in temperature is examined. Consideration of the relative magnitudes of the two currents leads to the conclusion that thermionically emitted electrons cannot be due to an internal photo-electric excitation.—*Bulletin Reprint B-214, Bell Telephone Laboratories*, November, 1926.

Traction

Electric Locomotives.—T. A. F. STONE.—The purpose of this paper is to present a method of classifying, analyzing and comparing the characteristics of electric locomotives. In order to classify the characteristics it is necessary, according to the author of this paper, to choose those that are common to both types and thence deduce a basis of comparison. The characteristics of steam locomotives include tractive efforts, heating surfaces, grate areas, cylinder volumes, adhesive weights, total weights in working order, weight of motive-power equipment and horsepower. The characteristics of electric locomotives include tractive efforts, adhesive weights, total weights in working order, weight of electric motive power equipment and horsepower. For the purpose of this investigation the characteristics of horsepower, adhesive weight, weight in tons of the motive-power equipment and the weight in tons of the locomotives in working order have been chosen common to both systems as being the most suitable. In order to carry out his investigations, the author collected data regarding 92 steam and electric locomotives, classified them and calculated the values of the characteristics above mentioned, as well as the values of the various ratios subsisting between them.—*Engineering (England)*, November, 1926.



COMPARISON OF TRACTIVE EFFORTS OF STEAM AND ELECTRIC LOCOMOTIVES OF SAME ADHESIVE WEIGHT

Construction of Ferrocarril de los Altos.—Such good progress has been made during the past few months in the construction of the Guatemalan mountain railway, Ferrocarril de los Altos, and the erection of a power station belonging to it that a portion of the line is expected to be in operation early in 1927. The extraordinarily bad conditions, which permitted the conveyance of only relatively small weights and loads have considerably delayed the construction, and it must be considered a noteworthy feat that up to the present no accident has occurred owing to the very difficult transport of the pipes. After the completion of the line from San Felipe to Santa Maria, where the steepest gradients are encountered it is expected that progress of the work will be considerably accelerated, as electric cars can then be employed for transport purposes.—*A.E.G. Progress*, November, 1926.

Miscellaneous

Mechanical Testing of Wire.—H. A. HOLZ.—The mechanical properties of wires are influenced by their chemical compositions, by the degree of cold working and heat treatment and by chemical treatment (such as pickling) which they have undergone in the manufacturing processes. An enumeration is made of the mechanical properties of wires which is of particular interest, including such items as static tensile strength, shearing strength, torsional strength, strength under the application of repeated stretches, elastic properties and plastic properties. The effect of annealing temperatures and the duration of anneal on the tensile strength and elongation of cold-drawn wire are discussed. Load producing and measuring systems of various kinds are described and illustrated. In a second installment of this article it is intended, according to the author, to go into further details concerning the tensile machine and to describe some of the horizontal cable-testing machines designed on the same principle. Other mechanical tests of wire and wire products will be taken up likewise.—*Wire*, December, 1926.

Electrical Industry in Sweden.—F. NIETHAMMER.—This article of fifteen pages represents the report of a two weeks' technical excursion to middle and south Sweden which was made last summer by a group of 50 engineers to study the present status and development of electrical industry. The subject is divided into three main chapters, "Generation, Transmission and Distribution," "Electric Railways," and "Factories and Shops."—*Elektrotechnik und Maschinenbau*, Oct. 24 and 31, 1926.

New Books

Electric Circuit Theory and the Operational Calculus

By John R. Carson. New York: McGraw-Hill Book Company, Inc. 193 pages, illustrated.

This is a rigorous and logical exposition and treatment of the Heaviside operational calculus and its application to electrical problems. For many years the mathematics of Oliver Heaviside was discredited because it seemed intuitive rather than logical and because rigorous proofs of its accuracy were not available. In this book a classical mathematician has subjected to rigorous treatment the powerful Heaviside operational calculus and proves it to be accurate and logical.

The general electrical circuit can best be solved by the use of operational calculus, and Mr. Carson starts from the beginning by building the circuit equations and then by taking the step-by-step developments which ultimately show the potency and simplicity of operational calculus for solving the equations. A mathematician will enjoy this work as one constituting a clear-cut and very logical exposition of mathematics of a unique character. But an engineer, also, will find this work one which contributes new tools and new facts for use when dealing with electrical circuits.

In the last part of the book the solution of current and voltage in transmission lines, the variable-circuit problem and some new mathematical solutions for complex circuits are presented. The work is based on a series of fifteen lectures given at the Moore School of Electrical Engineering at the University of Pennsylvania and shows the great care and thought that were given to its preparation. While not likely to become an undergraduate text or a popular engineering treatise, this book will be enjoyed and studied by engineers and scientists. It adds one more to the few classics on engineering subjects written in this country.

Magnetism and Atomic Structure

By E. C. Stoner. New York: E. P. Dutton & Company. 371 pages, illustrated.

The quantum theory has failed to satisfy the general problem of atomic structure because of its limitations when applied to magnetic phenomena. Few scientists have reached any degree of success in this approach to an explanation of magnetic phenomena. But Dr. Stoner has tried to do this work and has composed a very interesting treatise on the topic. In his opinion further study of magnetic phenomena will greatly strengthen the quantum theory of dynamic atomic structure and even will throw light upon the essential significance of the quantum theory itself. For this last reason, if for no other, he urges that the quantum theory should be studied in its magnetic applications.

Representative researches are presented and discussed in order to give an arbitrary but balanced perspective on the present state of the subject. Historical summaries are followed by a semi-historical discussion of the classical electromagnetic theory and early experimental investigations. Then the author discusses thoroughly magnetism as an atomic phenomenon and the several effects that have been noticed in magnetic researches. The quantum theory is used to explain many of these effects, and some stimulating researches are suggested by the discussions. As a semi-historical, philosophical and stimulating book on magnetism it can be recommended highly.

Zerstörungs und Alterungserscheinungen an Porcelan Isolatoren

By K. Draeger. Berlin: Julius Springer. 36 pages, 16 illustrations.

This little book, issued in the series of the Rosenthal ceramic works (No. 8), gives a short story of destruction and aging tests made on a great number of standard pin and suspension insulators for high-voltage lines. The assumption formerly widespread that porcelain insulators undergo certain gradual structural changes which impair their electrical and mechanical qualities has been proved baseless. All destructions and punctures are caused by external means, and if it is possible to prevent these by proper choice of porcelain, cement and electric stress, the life of insulators will be found to be very great. A. P.

Die Leistung des Drehstromofens

By Dr.-Ing. J. Wotschke. Berlin: Julius Springer. 70 pages.

The analytical treatment of the performance of electrical machinery and the construction of the corresponding vector and circle diagrams are familiar to all electrical engineers. Similar studies for the polyphase electric furnace have been published in but few instances. The reason is no doubt that the performance of the latter is much more elusive and that what might be called the constants of the furnace vary from instant to instant. And yet the modern furnace is a huge consumer of energy, currents up to 50,000 amp. not being unknown.

The monograph with the above title is an important contribution toward filling out this gap in technical literature. The treatment is substantially in accordance with well-established practice for the induction motor. Thus the author has found that the inductance of the furnace system is constant; the charge constitutes a variable resistance only. On this basis he first determines the fundamental equations, then discusses the "dead" phase, which is due to the transfer of energy from the trailing to the leading phase when the transformer leads lie in a single plane. Incidentally the same analysis applies also to a transmission system similarly arranged. He next develops equations for power and power factor, the circle diagram and the method of determining maximum value. The phenomenon of the dead phase can be combated by appropriate adjustment of the several secondary voltages so that the energy supplied by each phase is the same. The method of doing this is outlined. The scarcity of literature on the subject is well indicated by the bibliography, which includes but six titles, though it probably fairly indicates the situation. G. F. W.

High-Tension Line Practice and Methods

By E. V. Pannell. New York: D. Van Nostrand Company. 318 pages, illustrated.

This is a good book on the principles and practices of modern transmission-line engineering. It deals with materials, their assembly and construction methods. It is well illustrated and contains enough design formulas, data and economic principles to guide the engineer. It excels in treatment of modern line conductors, conductor supports and insulators. The economics of transmission-line design are treated briefly but correctly. No attempt has been made to discuss the electrical performance or characteristics of a high-tension transmission line.

As a practical book which fills a gap in the literature of the subject the volume should be welcomed by students and engineers. It is a logical, complete and workable text and reference book on line materials, line design and line construction.

Applied X-Rays

By G. L. Clark. New York: McGraw-Hill Book Company, Inc. 251 pages, illustrated.

Industry has discovered a new tool in the X-ray, and this book tells how this tool is produced and used. A brief exposition of X-rays and X-ray tubes is followed by a good discussion of the equipment for the production and use of X-rays. But the great value of this work lies in its clearly defined treatment of X-rays as a tool in various industries. The direct application of the rays and their use in analytical studies of processes and materials are well treated. In chemical work, in metallurgy and in the study of structures the X-rays have been found very valuable. The realm of application is widening each year, and the full industrial possibilities of these new tools are yet to be measured. In the meantime this book on current practice should serve to give to many industries valuable information on a new development.

Books Received

Industrial Safety Organization. By Lewis A. De Blois. New York: McGraw-Hill Book Company, Inc. 328 pages, illustrated.

Electric Trains. By R. E. Dickinson. New York: Longmans, Green & Company. 300 pages, illustrated. Price, $6.

Accounting Procedures for Public Utilities. By Warren G. Bailey and D. E. Knowles. New York: A. W. Shaw Company. 471 pages, illustrated. Price, $7.50.

News of the Industry

Interstate Transmission a Federal Matter

So Holding, United States Supreme Court Denies Authority of Rhode Island Commission to Increase Rates on Energy Sold in Massachusetts

A DECISION that may play a great part in future exportation of electrical energy generated in one state and transmitted across its boundary for sale in another was handed down by the United States Supreme Court on Monday of this week. The case under review was an appeal by the Public Utilities Commission of Rhode Island and the Narragansett Electric Lighting Company of Providence against a decision of the Rhode Island Supreme Court in favor of the Attleboro (Mass.) Steam & Electric Company. The latter company denied the right of the Rhode Island commission to increase, as the commission in 1921 attempted to do, the rates fixed in a twenty-year contract entered into in 1917 by which the Providence company was to supply energy at the Massachusetts border for use or resale by the Attleboro company, which on the signing of the contract dismantled its own plant.

The reason alleged by the Providence company for asking the increased rate was that under post-war conditions the contract figure was causing it a loss which was unfair to its Rhode Island customers. The Attleboro company maintained that in acceding to this request the Rhode Island commission went beyond its authority and came into conflict with the commerce clause of the United States Constitution. In deciding for the Massachusetts company and holding that Rhode Island had no more power to increase the rate than Massachusetts would have had to decrease it, and that the only relief lies in Congress, the highest court of the nation seems unequivocally to place interstate transmission of electricity in the category of interstate commerce and to have handed down a decision which may render nugatory the efforts, reported in recent issues of the ELECTRICAL WORLD, now under way among the New England States to govern interstate transmission by mutual agreement between the commissions of the commonwealths concerned and to keep the questions of rules and rates out of the hands of the federal authorities.

Part of the decision of the United States Supreme Court in the Attleboro-Narragansett case, which was written by Justice Sanford and from which Justice Brandeis dissented, was as follows:

"The test of the validity of a state regulation is not the character of the general business of the company, but whether the particular business which is regulated is essentially local or national in character, and if the regulation places a direct burden upon its interstate business, it is none the less beyond the power of the state because this may be the smaller part of its general business.

"Furthermore, if Rhode Island could place a direct burden upon the interstate business of the Narragansett company because this would result in indirect benefit to the customers of the Narragansett company in Rhode Island, Massachusetts could, by parity of reasoning, reduce the rates of such interstate business in order to benefit the customers of the Attleboro company in that state, who would have in the aggregate an interest in the interstate rate correlative to that of the customers of the Narragansett company in Rhode Island. Plainly, however, the paramount interest in the interstate business carried on between the two companies is not local to either state, but is essentially national in character.

"The rate is, therefore, not subject to regulation by either of the two states in the guise of protection to their respective local interests; but if such regulation is required, it can only be obtained by the exercise of the power vested in Congress."

For St. Lawrence Route

American Commission Headed by Hoover Holds that Its Power Feature Makes It the Best

UNQUALIFIED recommendation for the construction by the United States and Canada of a shipway from the Atlantic into the Great Lakes via the St. Lawrence River is contained in a report just presented to President Coolidge by Secretary Hoover, who is chairman of the commission on the subject known as the United States St. Lawrence Commission. The report definitely rejects the proposal for an all-American canal through New York State as uneconomic and impracticable at the present time, but declares that the opening of the Great Lakes-to-ocean navigation is "imperative both for the relief and for the future development of a vast area within the interior of the continent."

Secretary Hoover's report, incorporating cost estimates by engineering boards representing this country and Canada, fixes the cost of the St. Lawrence Canal at between $123 000 000 and $148,000,000, exclusive of power plants, as contrasted with an estimated cost of $506,000,000 for a route from Lake Ontario to the Hudson River and with a cost of $631,000,000 for the all-American plan.

Considering the tonnage that would move to and from the ocean to the Great Lakes should a way be opened, the report calculates that the total cost per ton necessary to carry operating expenses of the St. Lawrence Canal would be 43 cents. For the all-American route the cost per ton is figured to be $2.06, while if the St. Lawrence-Hudson canal were constructed the cost would be $1.64.

The vastly lower figure for the St. Lawrence waterway, the report says, was arrived at in consideration of the great power development that would result from damming of the stream for navigation purposes. No such prospect attaches to the all-American route. Should the St. Lawrence power be developed, the report says, New York interest in its utilization should be largely considered.

Provided that agreement can be reached with Canada and that proper agencies can be set up to control the incident power creation, the Hoover commission advises the United States to proceed immediately with the project.

Alabama and Muscle Shoals

Governor Graves Asks for Joint Legislative Committee to Report on Rights of State

IN HIS first address to the Alabama State Legislature Bibb Graves, the newly elected governor of that state, aroused much interest by raising the question of Alabama's right as a state to a part in deciding what shall be done with Muscle Shoals. For a long time the assertion has been made that Alabama had rights in the federal government's development that had never been surrendered. However, there has been comparatively little discussion on this point in recent years.

"It seems," said Governor Graves, "that the Congress is undertaking to dispose of the Muscle Shoals water power without due consideration of the rights of the State of Alabama. The state as well as the nation has rights both legal and ethical in Muscle Shoals power and in Wilson Dam. Each sovereignty should respect every right of the other. Neither has the right to sole disposition of this property, and in any arrangement with regard thereto neither should act independently of the other. While limitations in law do not run against a state, still by sitting idle while conflicting interests vest in good faith a state may morally estop itself from asserting its rights.

"Hence I believe that we should ascertain, declare and undertake to assert the rights of our state in the premises before any bona fide purchaser, lessee or grantee from Congress shall acquire any interest therein that might be adverse to the rights of the State of Alabama. Since there

seems to be no definite power in the hands of the Governor or any other state officer to assert these rights, I suggest the raising of a joint committee which shall ascertain the law and the facts in this case and report back to you for such action as you deem right and proper.

"I believe that Wilson Dam belongs at least in part to the State of Alabama. I am convinced that the bed of the Tennessee River on which this dam is built is the property of the state; that not only the dam but the water in the river and the power in the water is on our land, subject, of course, to the government's power to regulate navigation and subject to easements of riparian owners. I have made some investigation but have not found any steps were ever taken to divest the State of Alabama of its title to the land on which Wilson Dam is built. The original government grants to the lands at the abutting ends of this dam extended only to low water mark of the river. When these abutting lands were acquired, the acquisition could not extend beyond the limits of the original grants. Hence the land included in the bed of the river on which this dam is built is the property of the State of Alabama.

"Our state Supreme Court has consistently held that the beds of navigable streams belong (subject to navigation control and easement of riparian owners) to the state. Our federal Supreme Court has consistently upheld the right of the state to declare the law within such state relating to this matter. There is much involved and there is sufficient reason to justify your investigation. I earnestly recommend that such a committee be raised, charged with ascertaining and reporting back to you what are the state's rights in the premises, together with such recommendations as it may see fit to make as to necessary procedure to protect the rights of the State of Alabama."

Repeal of Non-Exportation Law Sought in Maine

When the Maine Legislature convened on Wednesday of this week there seemed to be every prospect that modification of the Fernald law of 1909 prohibiting the exportation of water power would be vigorously sought during the session. Governor Brewster's inaugural address declared that under no circumstances should Maine relinquish any portion of its control, jurisdiction and regulation over the hydro-electric resources within its borders, but the Governor said that some common ground may yet be found on which all may stand, including both advocates and opponents of exportation.

The desire to avoid federal regulation of generating companies now appears to be the controlling motive with those who would retain the prohibitory law. Present indications are that an attempt will be made by these advocates of restriction to pass an amendment denying all generating companies the right to export hydro-electricity and keeping such companies under the regulation of the Public Utilities Commission. The decision of last Monday by the United States Supreme Court in the Rhode Island-Attleboro case is believed to establish beyond all question the right of the federal government to regulate interstate power transmission. On the other hand, advocates of power exportation from Maine point out that millions of dollars have been lost to the state through the failure of the Fernald law to bring new industries into the state by the lure of cheap power, and there is a strong feeling among utility men that the law should be modified.

Smith Repeats Power Ideas

"Protect Consumer at Busbar," New York Governor Says—Reiterates Also Views on Regulation

GOVERNOR SMITH in his annual message to the New York State Legislature, delivered on Jan. 5, was perhaps more explicit in his outline of a plan for development of state-owned water power than in any previous recommendations. He renewed his recommendation for the creation of a State Power Authority, organized along similar lines to the Port of New York and Albany Port authorities, and would have such a body work out a comprehensive plan for development, including the details of the financial structure necessary, which, when approved by the Legislature, would constitute the plan under which the development would be made. The Governor, after reviewing in his message the political and legislative history of attempts to develop the Niagara and St. Lawrence River powers, said:

"Experience with regulatory bodies and recent court decisions make it extremely doubtful, once control has passed away to private interests from the people themselves by lease or franchise, that public interests can receive from these bodies the measure of protection which they require. To attempt to protect the consumer only through the regulatory power of the state is to hold out to him a promise which we know cannot be fulfilled. Public utility regulation by public service commissions or the Interstate Commerce Commission involves long-drawn-out battles in which experts disagree over capital accounts. The place to protect the consumer is at the busbar when we make the contract for the sale of the power. In that contract we can make certain that the capital investment will be accurately agreed upon and even the charge to the consumer determined in advance, as we have done in the housing law."

Again asserting that the federal government in its Boulder Dam proposals is turning to the type of organization he favors, Governor Smith said further:

"The Power Authority should . . . be required to report to the Legislature at the earliest possible moment a comprehensive legal, financial and engineering plan for the development of the water-power resources of the state. Until the plan is adopted by the Legislature the Power Authority will have no right to proceed. Once the plan has been adopted, the Power Authority can proceed to finance the projects by the issuance of its own securities. The Legislature's control is safeguarded by conditioning the exercise of the powers of the Power Authority upon its own approval of such a comprehensive plan, following the precedent the Legislatures of New York and New Jersey adopted in dealing with the Port of New York. Until such time as the comprehensive plan has been adopted by the Legislature, an expenditure of $100,000 will settle the question for all time."

The Power Authority, the Governor adds, should be enabled to represent the state in the important negotiations that must be conducted with other states, the federal government and with Canada.

REGULATION OF PUBLIC UTILITIES

Governor Smith in his message also renewed his recommendations for municipal regulation of public utilities and the conferring upon municipalities of the right to own and operate such utilities. In this respect the Governor said:

"I have not changed my opinion with regard to the regulation of such utilities wholly within the confines of a city. I reiterate that I believe that the state should be empowered to delegate to localities, when they so request, or to an agency established and designated by the local government, the regulatory powers now held by state agencies. If this is done only upon request of the locality, it will preserve every feature of the home-rule principle."

The Governor made no specific recommendations concerning the reorganization of the commission.

Massachusetts Rate Inquiry Is Asked

Representative Henry L. Shattuck of Boston has filed a proposed order with the Massachusetts House of Representatives for a general investigation of the rates of gas and electric companies within the state by the Department of Public Utilities. The order would also empower the commission to consider and recommend changes in laws regarding the issue of capital by gas and electric utilities. In effect, the order would permit a general revision of existing legislation bearing upon the financing and sale of gas and electricity throughout Massachusetts.

Change Sought in Wisconsin Commission Law

The right of the Wisconsin Railroad Commission to pass upon the probable efficiency and success of a company seeking to finance a public utility company, with a view to protecting investors, will be presented before the new Legislature by Lewis E. Gettle, chairman of the Wisconsin Railroad Commission, so that legislation may be framed for a change in the present statutes covering this point. Mr. Gettle's action was the result of a ruling recently handed down by the Circuit Court in the case of the Central Steam

Heat & Power Company of Madison, which proposes to issue stocks and bonds for financing heating plants at Port Washington and Plymouth. The commission refused to authorize the issuance of bonds, and the case was appealed to the Circuit Court, which ruled in favor of the company on the ground that the commission acted "without authority in passing on the probable efficiency of a company."

Governor Hunt Asks Money to Fight Boulder Dam

In a special joint session of the Arizona State Legislature convened Tuesday, Governor Hunt asked for an open appropriation out of which to defray the expenses of attorneys, engineers and other experts whom he may appoint to fight the Swing-Johnson Boulder Canyon Dam bill now before Congress with the favorable recommendation of both the Senate and House committees on irrigation behind it. Members predicted, in the recess which followed the Governor's request, that opposition in both chambers was a certainty. Senate bill No. 1, presented Wednesday morning, contemplates the appointment of three commissioners by the Governor, two by the Senate and two by the House, these commissioners to have full powers to negotiate with the various Colorado River Basin states, subject to acceptance or rejection by the Legislature. This bill also provides an appropriation of $200,000 to carry out its terms. The bill has been referred to the committee on agriculture and forestry.

California and Arizona Differ Over Colorado Royalties

The tri-state conference between Arizona, California and Nevada, which had been in session in Los Angeles since Dec. 15, adjourned on Dec. 31 without having arrived at a definite solution of the problems brought up in connection with the development of the Colorado River. On one phase alone were the conferees in accord. That was on the allocation of water from the river among the three states contingent upon a settlement of the power revenue issue. The question of a division of power revenues remains to be settled. On adjourning the conferees tentatively fixed Jan. 11 as the date when they will resume their deliberations. Just how the resumption of deliberations is to be accomplished is not certain, inasmuch as the authority of the California commission expired at midnight of Dec. 31. Delegates from Arizona and Nevada expressed the hope, however, that they could find some representatives authorized to speak for California when the time arrives.

On the power question California has expressed a willingness to pay Arizona a royalty of $1 per horsepower per annum. Arizona delegates, however, are demanding $6. The official statement issued at the close of the conference by Chairman Squires of Nevada follows:

"The commissioners of Arizona, California and Nevada discussed the matter of revenue to be derived by the states in which power may be developed, on the basis of taxation. It was conceded by the California commissioners that the states in which power is developed have the right to a reasonable revenue therefrom, but the conference disagreed on the question of placing a limitation on the amount which could be levied. Commissioner Maddock of Arizona presented a proposal which embodies the idea that a board of arbitration composed of one member each from California, Arizona and Nevada and one representative of the federal government should be constituted, to which questions as to the reasonableness of the amount of any levy made by any of the states might be submitted for decision."

Philadelphia Electric's New Office Building

EXCAVATION has been started for the new headquarters office building of the Philadelphia Electric Company on the southwest corner of Sansom and Ninth Streets. This building will be 25 stories high and of concrete and steel construction with an exterior of brick and limestone on a site 100 ft. x 104 ft. The cost of the structure is estimated at $2,000,000. The architect is John T. Windrim of Philadelphia.

Opposition to Boulder Canyon Bill at Washington

Minority views on the Swing-Johnson Boulder Canyon bill will be submitted to the House of Representatives by Representative Hayden of Arizona, Representative Leatherwood of Utah and Representative Whittington of Mississippi. Each of the members mentioned will submit a separate minority report.

There is decided opposition to the Swing-Johnson proposal in that the bill as it now reads would make it possible to put the government in the power business to the extent of 1,000,000 hp. The bill does contain a rather obscure alternative for the leasing of units of the dam to those interested in developing power, but in view of official announcements which have been made it seems likely that the alternative of selling the power at the busbar and providing for the joint use of transmission lines is more likely to be undertaken. Those opposing the bill declare that the joint use of transmission lines is impracticable, but they would have no objection to the measure were that feature eliminated and the government required to lease the dam. If agreement can be reached on those differences, it is believed the bill has a chance to pass at this session of Congress.

Notes from the Capital of the Nation

Before reporting to the Federal Power Commission on the Upper Tennessee River applications O. C. Merrill, the commission's executive secretary, is seeking additional data on the amount of power the South may be able to absorb. There is some question in his mind whether a market can be found for all the power that would be developed if all the proposed developments are carried out.

Representative Madden, the chairman of the appropriations committee, has come out in opposition to the requirement that the Federal Power Commission conduct its work with personnel borrowed from the War, Interior and Agricultural Departments. He regards such a procedure as unbusinesslike and favors a direct appropriation to the commission for that purpose.

A bill proposing to withhold from the Federal Power Commission the authority to pass upon declarations of intention has been introduced by Representative Garrett of Tennessee. Mr. Garrett is understood to have been prompted to take this action when the commission held that a proposed project of the Holston River Power Company on the South Fork of the Holston River comes under the jurisdiction of the commission. The Tennessee Eastern Electric Company of Johnson City, which owns lands on that stream, contends that the commission should not take jurisdiction.

Political Harmony Over Ohio Commission in Sight

With the resignation of George T. Poor as a member of the Ohio State Public Utilities Commission effective Jan. 1, 1927, peace looms after a long controversy between Governor A. V. Donahey and the Ohio State Legislature. The Governor is a Democrat, and the Legislature is strongly Republican. Since he first became chief executive Mr. Donahey has several times attempted to change the personnel of the commission, but has failed to obtain

confirmation of his appointments by the Senate. At one time he made an effort to have Mr. Poor removed, carrying to the Supreme Court a charge that Poor, because of ownership of utility stock, had disqualified himself as a commissioner. The court, however, ruled otherwise.

Failure of the Senate to confirm the Governor's nominees in the past created a situation whereby Mr. Poor and C. C. Marshall, chairman, have continued as members of the commission for two and four years, respectively, after the expiration of their terms. To fill these expired-term vacancies on the commission two members are now to be appointed by the Governor, and it is thought probable in Ohio political circles that the Senate will confirm the appointments. Mr. Poor, who was appointed in January, 1921, by Governor Harry L. Davis, leaves the commission to enter upon the practice of law.

Purchases and Mergers

No Important Consolidation Recorded in First Week of Year—More Sales of Municipal Plants

MERGER of the Blue Ridge Power Company, Hendersonville, N. C., with the Broad River Power Company, of Columbia, S. C., both subsidiaries of the General Gas & Electric Corporation, has been announced.

Purchase for $300,000 of the municipal hydro-electric plant at Pompton Lakes, N. J., in accordance with the decision of the voters, is announced by the Jersey Central Power & Light Company. Pompton Lakes is already reached by the transmission lines of the company, a Fitkin property.

The Ohio Electric Power Company has asked the Public Utilities Commission for authority to purchase the Coldwater Lighting Company at a reported price of $35,000.

Citizens of Laurens, Iowa, have voted two to one in favor of the sale of the municipal light and power plant to the Central States Electric Company of Cedar Rapids. The Vincent (Iowa) municipal electric distribution system has been sold to the Central Iowa Light & Power Company for $10,000.

The Kekoskee (Wis.) Light & Power Company has been purchased and made a part of the Northwestern Light & Power Company of Mayville, Wis., from which it has been purchasing energy at wholesale. Approximately $43,000 is understood to have been involved in the transaction.

Madison (N. C.) voters have unanimously resolved to sell their electric system to the Southern Public Utilities Company.

The South Georgia Power Company has purchased the distribution system in Butler, Ga., formerly owned by the Butler Light & Power Company.

An option for the purchase of the Condo (N. D.) electric light plant for $40,000 has been given the Drake-Jones Electric Company for 60 days, the sale being subject to the outcome of a special election.

The proposal submitted to Alma (Neb.) voters to sell the municipal electric light and ice plant for $87,000 to interests connected with the Iowa Light & Power Company of Cedar Rapids was defeated by a vote of 14 for and 382 against. The overwhelming defeat is said to have been due to the fact that representatives of other companies visited Alma a few days before the election and offered to raise the bid under consideration.

A plan to merge nine electric, gas and traction companies now operated under long-term leases by the Public Service Electric & Gas Company has been put before the New Jersey State Board of Public Utility Commissioners by the company named, which desires to issue $42,000,000 in bonds to acquire the stock of these underlying companies. They are the Essex & Hudson Gas Company, Hudson County Gas Company, South Jersey Gas, Electric & Traction Company, Gas & Electric Company of Bergen County, New Brunswick Light, Heat & Power Company, Newark Consolidated Gas Company, Paterson & Passaic Gas & Electric Company, Somerset, Union & Middlesex Lighting Company and Ridgewood Gas Company.

Program of the American Engineering Council

The plan to centralize in a single Cabinet office all the functions of the federal government which affect public works and the public domain will come before the assembly of the American Engineering Council for approval at the council's annual meeting, which will be held in Washington on Jan. 13 and 14. The report of a special committee on organization of federal public works was adopted recently by the council's administrative board at a meeting held at Cornell University and now goes to the assembly, or "engineering parliament," composed of members of 30 national and local engineering societies, for final action after public discussion. Should the proposal be approved, a nation-wide movement among engineers will follow to abolish the present form of the Department of the Interior and to establish a Department of Public Works and Domain. A detailed program of reorganization, accomplishing, it is claimed, large savings in money and increased efficiency in government through a regrouping of bureaus, commissions, offices and other services, has been worked out.

A special meeting of the assembly, Dean Dexter S. Kimball of Cornell, president of the council, presiding, has been called for the evening of Jan. 13 to hear the report of a nation-wide study of safety and production in industry. The report will be presented by A. W. Berresford of Detroit, chairman of the investigation committee. Addresses will be made by Leon P. Alford of New York, a member of the committee; Joshua Evre Hannum, research engineer of the Eyesight Conservation Council of New York, and Lawrence W. Wallace of Washington, executive secretary of the American Engineering Council. Many representatives of industry and the federal government, including Secretary of Labor Davis and the directors of the Bureau of Mines and the Geological Survey, are expected to attend.

Charles M. Schwab, president of the American Society of Mechanical Engineers, will be the chief speaker at the annual dinner of the council, to be held on the evening of Jan. 14 at the Mayflower Hotel. Meetings of the council's executive committee and administative board will be other events of the sessions. Election of new members of the council will be announced.

Transmission in Florida

Florida Power & Light Company Completes Its 800-Mile System—Fort Lauderdale Station Opens

ANNOUNCEMENT is made by the Florida Power & Light Company that the last mile of transmission line in its present construction program has been built and as a result all of the company's electric generating stations and distribution systems in the 90 communities served, except for a few isolated ones, are now interconnected and will be operated as one system. This interconnected transmission system is more than 800 miles in length and extends from St. Augustine, the northernmost city served by the company on the east coast, south to the Miami district, tying in the properties at Palatka, Daytona Beach, Sanford, Titusville, Cocoa, Melbourne, West Palm Beach, Palm Beach, Fort Lauderdale, Hollywood, Miami and Miami Beach and all intervening points served by the company. In the southwestern section of the state the transmission line extends from Bradenton through Sarasota and Venice to Punta Gorda and Fort Myers. A line extending across the state from Punta Gorda, through Arcadia and Okeechobee to Fort Pierce on the east coast, interconnects these two transmission systems.

These 800 miles of transmission lines have been built during the last two years. Prior to that time all the electric properties in the 90 communities now served by the Florida Power & Light Company were operated as individual units. Three years ago there were practically no transmission lines in the entire State of Florida.

In connection with the building of this transmission system, the Florida Power & Light Company has also built and recently placed in operation two good-sized generating stations. The Sanford station, on the St. Johns River near Sanford, has been designed and partly built for a capacity of 100,000 kw. and, as already noted, was placed in operation recently. It has an initial capacity of 10,000 kw. The Lauderdale station, on the New River near Fort Lauderdale, has been designed and partly built for an ultimate capacity of 150,000 kw. and an initial installation of 50,000 kw., consisting of two units of 25,000 kw. each. One of these units was placed in operation in December, and the other, it is expected, will be placed in operation this month. With the completion of the transmission system and these new superpower stations, several of the older and smaller generating stations owned by the company will be used only for standby purposes.

Work on Long Beach No. 3 to Start

Additional Details on Equipment and Design of Southern California Edison's Coming Seven-Million-Dollar Steam Unit—Eventual Plant Rating, 937,500 Kw.

WORK on the installation of the first 100,000-kw. unit of the new Long Beach steam plant No. 3 of the Southern California Edison Company is to begin at once, according to an announcement just made by George Clinton Ward, vice-president in charge of operation and construction for the company. Present plans call for the eventual installation of eight such units, which will bring the total capacity of the entire Long Beach steam plant to more than 937,500 kw. This first unit is to be ready for operation Feb. 1, 1928, and is to cost, together with necessary transmission and distribution equipment, approximately $7,000,000.

This new structure is to be placed immediately adjacent to the present steam plant, the first unit of which was built in 1912. It is to be of reinforced concrete construction, 250 ft. long by 230 ft. wide by 90 ft. high. As new units are added the structure is to be lengthened to a full 1,000 ft. To furnish a suitable foundation more than 7,500 piles averaging 40 ft. in length are to be driven. Inside of the turbine hall the turbine itself will rest upon a reinforced concrete structure 32 ft. high.

The turbines, as was reported in a preliminary account of this plant printed in the ELECTRICAL WORLD for Sept. 11 (page 541), are to be built by the General Electric Company. They will operate under a steam pressure of 450 lb. and a steam temperature of 750 deg. They will be of a tandem-compound type with double flow in the low-pressure unit and will have eighteen stages in the high-pressure cylinder and three stages in the low-pressure cylinder. They will, it is said, be the largest single-shaft steam turbines ever built. Because of its immense size the condenser is to be made up in four sections, which are to be constructed vertically to make possible efficient grouping about the turbine.

Salt water for cooling purposes is to be brought in from Long Beach Channel and then discharged directly into a discharge tunnel 25 ft. in diameter and 1,000 ft. long, thence by an open creosoted flume, also 1,000 ft. long, directly into the ocean. Four special air blowers are to be used to circulate the air used in cooling the generator. This is a departure from the normal method of having the air kept in circulation by means of fans fastened directly to the shaft. This new system has been so constructed as to make possible the use of hydrogen as a cooling agent when that method has been perfected. The condensers are to be built by the Ingersoll-Rand Company.

A complete set of recording instruments for recording performance is to be included as a part of the regular installation. These instruments will accurately register every feature of the plant's performance at all times so that it may be said that the plant is always operating "under test," instead of the usual "staged" periodic tests. This elaborate set of recording instruments is to be built in because, with the large amount of fuel which the plant must of necessity use, it was felt that there was a possibility of minor troubles causing great losses of efficiency under the "stage" test system.

Three complete Babcock & Wilcox boilers and furnaces are to be installed for the first unit. Each of these boilers will have a heating surface of 35,000 sq.ft. Boiler and furnace together will stand 64 ft. high, 34 ft. wide and 24 ft. deep. The furnaces will be arranged so as to burn oil, gas or pulverized coal. All furnace walls are to be water-cooled. The air used for combustion is to be preheated to 450 deg.

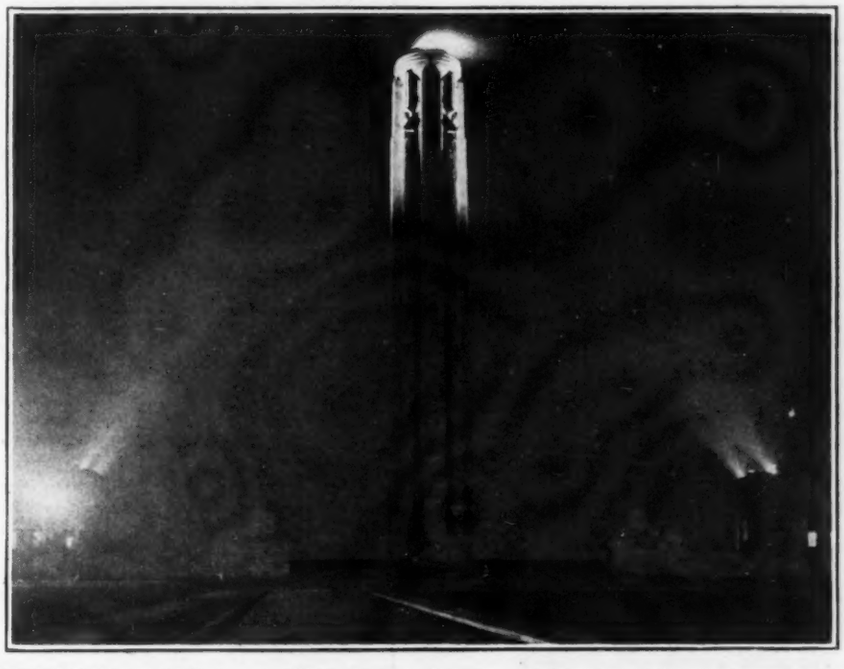
Electricity is to be generated at 16,500 volts and then stepped up to 220,000 volts and sent out over two new 220,000-volt steel-tower lines to connect with the present 220,000-volt system. The take-off towers will extend 260 ft. above the ground, while the new crossing towers over Long Beach Channel will be 310 ft. high.

Fishery Men See Propaganda in Fish-Ladder Reports

Statements which have been made in the technical press and daily newspapers concerning the success of the fish ladder at the Baker River dam of the Puget Sound Power & Light Company near Concrete, Wash., were characterized as unwarranted and misleading "nation-wide propaganda" by the International Pacific Salmon Investigation Federation at its annual meeting held in Seattle recently. Included in the federation are fisheries officials of the United States, Alaska and Canada. In a resolution the federation asserted that the experimental fish ladder had had only partial success and that no solution of the problem had been reached that could properly be considered as of general application.

In connection with the Baker River fishway, referred to in an editorial on page 156 of the issue of the ELECTRICAL WORLD for July 24, 1926, and shown in picture on page 312 of the Aug. 14 issue, it is pertinent to note that during the 1926 salmon run 12,000 mature salmon passed over the dam on their way to the spawning grounds and that tens of thousands of young salmon made the leap from the top of the 260-ft. dam to the pool below in the spillwater, going over without apparent injury.

Kansas City Floodlights Its World War Memorial



KANSAS CITY'S magnificent memorial in honor of those who served in the World War, dedicated on Armistice Day by President Coolidge, has been made as visible by night as by day through floodlighting. Sixteen 18-in. General Electric incandescent searchlamps of 1,000 watts each compose the equipment for lighting the upper part of the shaft, the apparatus being so arranged as to provide rectangular instead of cylindrical beams. Inside the bowl, at the top, are four General Electric type L-15 floodlamps, equipped with amber-colored doors, the light from which is thrown on the clouds of steam escaping from the bowl.

The memorial, which cost $2,000,000, is of Indiana limestone in its natural colors of cream, buff and gray. Steel and concrete were used in the construction. It is 600 ft. long, including the east and west buttresses and flights of platoon-wide steps. The central shaft is 217½ ft. from the visible base to the top. At this base it is 36 ft. in diameter and at the top 28 ft.

Briefer News

Buenos Aires' New Plant Under Way.—Construction work on the first stage of the new power plant in Buenos Aires is under way, according to *Commerce Reports*. The plant is designed for an ultimate installation of 225,000 kw. in twelve generating units and will be the largest in South America, it is said.

Nebraska Engineers Ask for License System.—The engineers' clubs of Omaha and Lincoln have prepared for introduction at the session of the Nebraska Legislature which began Jan. 4 a bill creating a state board of examination, setting up standards which the applicants for engineering licenses must meet and providing for a license system. This is the third effort to bring about the passage by Nebraska of a measure of this kind.

Savannah (Ga.) Plant Expands.—Stone & Webster, Inc., have just put into operation at Savannah, Ga., a new 15,000-kw. turbo-generator for the Savannah Electric & Power Company. This installation, together with that of two 400-hp. pulverized-coal-burning boilers, is expected to effect material savings in the operating costs of the Savannah company, which is a subsidiary of the Engineers' Public Service Company.

Central Maine Power Company Bridges Arm of Atlantic.—By the completion of an 11,000-volt cable laid under an arm of the Atlantic separating Castine, Me., from Islesboro, an island two miles off the coast of that state, electricity was brought to the islanders for the first time. Nearly every house on the island had been wired in anticipation and street lamps had been installed. The territory belongs to the Central Maine Power Company of Augusta, and the work was put through by its engineers.

Central-Station Employees Run Village.—Columbia Park, the location of the Columbia power station of the Union Gas & Electric Company, Cincinnati, has had its first election of village officers, all of whom are employees of the company. Among the new councilmen are Chief Engineer J. H. Heimbrook, Vice-president C. W. De Forrest and Superintendent D. S. Brown, the last-named ex officio. A mayor will be selected at the first meeting of Council. The population of Columbia Park has reached a total of 168 men, women and children.

Laclede Light & Power Company Set Up in St. Louis.—The Missouri Public Service Commission has approved the formation of a subsidiary corporation to control and operate the electric property of the Laclede Gas Light Company and the Phoenix Light, Heat & Power Company of St. Louis, at an annual rent of $394,000. The new company will be known as the Laclede Light & Power Company and will issue 13,200 shares of non-par-value stock to be sold at $10 a share to the stockholders of the Laclede Gas Light Company in the ratio of one share for every ten shares of Laclede Gas Light stock now held.

Uniform Rates in All Communities Served Fixed by South Georgia Power.—Uniform lighting and power rates in all communities now served by the South Georgia Power Company have become effective and will apply to other communities in the territory as transmission lines now under way reach them, according to an announcement made by officials of the company. The rates are those established by the Georgia Public Service Commission for the former Georgia-Alabama Power Company, the nucleus about which the new system was developed. The towns on the present lines in which this action will effect a rate reduction are Americus, Cordele, De Soto, Leslie, Montezuma, Oglethorpe and Smithville.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 1, page 80.

American Engineering Council—The Mayflower, Washington, D. C., Jan. 13-15. L. W. Wallace, 26 Jackson Place, Washington.

Empire State Gas and Electric Association, Electric Section—New York Edison Auditorium, 44 West 27th St., New York, Jan. 14 and 15. C. H. B. Chapin, Grand Central Terminal, New York.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 17 and 18. F. D. Weber, Box 745, Portland.

National Electrical Manufacturers' Association (Supply Division)—New York, Jan. 17-21. S. N. Clarkson, 30 East 42d St., New York.

National Electric Credit Association—New England Division, Boston, Jan. 18. F. P. Vose, 1008 Marquette Bldg., Chicago.

Western Association of Electrical Inspectors—Kansas City, Mo., Jan. 25-27. W. S. Boyd, 175 West Jackson Blvd., Chicago.

Electrical Supply Jobbers' Association, Pacific Division—Del Monte, Cal., Jan. 27-29. F. Overbagh, 411 South Clinton St., Chicago.

National Association of Lighting Equipment Dealers—Hollenden Hotel, Cleveland, Jan. 31-Feb. 5. G. P. Rogers, 424 Guarantee Title Bldg., Cleveland.

Northwest Electric Light and Power Association, Commercial Section—Multnomah Hotel, Portland, Ore., Feb. 10 and 11. L. A. Lewis, Washington Water Power Company, Spokane, Wash.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18; Middle Eastern, Bethlehem, Pa., April 14-16. F. L. Hutchinson, 36 West 39th St., New York.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Feb. 18 and 19. E. F. Kelley, Louisville Railway Co., Louisville.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

Southwestern Division, N. E. L. A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Bethlehem Steel to Use 12,000 Hp. of Energy at Coatesville, Pa.—Officials of the Bethlehem Steel Company have just signed a power contract for its Coatesville (Pa.) shop with the Chester Valley Electric Company, a Fitkin subsidiary. The contract calls for 12,000 hp. of connected load for a period of five years and involves $1,500,000. The Coatesville shops have heretofore been supplied with power from their own steam plant. Construction work has been started to connect the Bethlehem plant with the Chester Valley station, and the load will be taken over when this work is completed.

Alabama Power Company's Tallassee Plants to Be Reconstructed and Enlarged.—Upper Tallassee Dam, which is on the Tallapoosa River, 7 miles below the Martin Dam development of the Alabama Power Company, is to be converted into a major development by increasing its head from 36 ft. to 57 ft. and its capacity from 8,500 hp. to an initial installed capacity of 50,000 hp. Provision will be made to install a third unit of 25,000 hp. rating later. Work on the project will begin early in 1927, a thousand men being employed on the job. The construction camp will be between the Upper and Lower Tallassee dams, and the latter is to be converted into a major development as soon as work on the upper project is completed.

Suit Over Alleged Infringement on Name of Public Utility Company.—An unusual suit, the result of which may prove far-reaching owing to the rapid growth of the public utility industry, has been entered in the United States District Court at Wilmington, Del., by the Associated Gas & Electric Company of New York against the Associated Public Utilities Corporation of Delaware, asking that the latter, a recently organized company, be enjoined from using the word "Associated" in relation to "Public Utilities" as a part of its corporate title. The Associated Gas & Electric Company contends that it alone is entitled to good will built up as the company pioneering in the use of the word "Associated" among public utilities.

Michigan Increases Consumption of Electricity by 500,000,000 Kw.-Hr. in Year.—Asserting that "Michigan is thriving on the diet of electric power and its ability to consume it seems to be unlimited," D. E. Byerley, president of the Michigan Electric Light Association, added: "During the twelve months ended with November the state used half a billion more kilowatt-hours than in the corresponding previous year." Consumption for this period was 3,391,078,000 kw.-hr., compared with 2,937,984,000 kw.-hr. for the period ended November, 1925. Water powers of the state produced 773,000,000 kw.-hr., or 75,000,000 kw.-hr. more than in the previous year.

Hydro-Electric Projects in Connecticut.—The Central Connecticut Power & Light Company, East Hampton, Conn., is considering plans for expansion at its Leesville power plant that will entail an expenditure of $1,000,000. Immediate plans, which are subject to

legislative approval, involve the construction of a dam on the Salmon River. Additions would then, it is planned, be made to the power plant and energy would be furnished to the Essex Power & Light Company, which now buys power from the Eastern Connecticut Light & Power Company, Norwich. In the last-named city a contract for the superstructure of a municipal hydro-electric plant on North Main Street has been awarded. The new station will have a capacity of 4,200,000 kw.-hr. a year. About 7,000 tons of coal will be saved by its construction, the city estimates.

Hamilton, Ohio, Going Ahead with Municipal Plant. — Despite continued opposition, the City Council of Hamilton, Ohio, is getting plans under way for the construction of the half-million-dollar light and power plant for which a bond issue is available. A Toledo firm has been engaged to prepare plans.

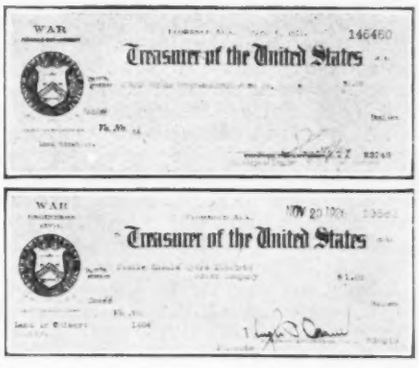
Minneapolis Officials Inspect Light and Power Plants.—A new conception of the task of providing Minneapolis with electric power was had by 65 city and county officials and manufacturers as the result of a recent official visit to the properties of the Northern States Power Company. Visits were paid to the transformer station, the Riverside steam plant and other properties. Operation of the turbines at the Riverside plant were explained. The visitors were entertained at a luncheon given by the company, Robert F. Pack, vice-president and general manager of the company, presiding.

Byllesby Interests Plan Water-Power Development on Rogue River, Ore.—In addition to its hydro-electric project at Chippewa Falls, Wis., already reported in these columns, H. M. Byllesby & Company announce plans for one on the Rogue River in Oregon to serve the California-Oregon Power Company. It will have an ultimate capacity of 66,000 hp. and the first unit of 22,000 hp. is expected to be ready by Oct. 1. The cost is put at $3,250,000.

Plans for Vienna (Md.) Plant of Fitkin System.—The National Public Service Corporation has authorized a new central station for the Eastern Shore Gas & Electric Company on the Nanticoke River at Vienna, Md., at a cost of approximately $1,500,000, not including $500,000 for transmission lines. The Eastern Shore company, a subsidiary of the National, serves Delaware-Maryland-Virginia territory which is sometimes referred to as "Delmarva." (See ELECTRICAL WORLD for Nov. 6, page 979.) The Delmarva Power Company has been organized to construct the station, now being designed by engineers of the General Engineering & Management Corporation. It will be constructed in units, the initial installation calling for two 6,000-kw. Westinghouse turbo-generators. The site is 12 ft. above the river level at a railroad crossing. This will permit the delivery of fuel by barge from Norfolk or Baltimore or by rail from Wilmington. To connect the plant to the general system it will be necessary to carry a 1,600-ft. span across Nanticoke River on 200-ft. towers. The plant is expected to be in operation by December, 1927.

Increasing Rural Service in Ontario. —The rural service of the Ontario Hydro-Electric Power Commission has been greatly expanded during the year, the number of farms now supplied with power being about 18,500, according to R. T. Jeffery, chief of the municipal engineering department of the commission, which has supervision over this branch of the service. Mr. Jeffery says that 2,240 miles of rural line has already been constructed, 700 miles of which were built this year to serve about 5,000 new consumers. This makes a record year. The commission proposes, he says, to construct about 600 miles a year for several years ahead. Contracts are now held with approximately 180 townships, the township accepting the responsibility for the payment of all charges by the customers within its boundaries.

Alabama Power Company Collects Belated Federal Dollar.—In 1918 the Alabama Power Company agreed to donate to the United States government the Wilson Dam site and certain



flowage lands to aid the government in producing nitrates for war purposes. In due course the company executed two deeds to the United States conveying the lands, each expressing the consideration of $1. One check for this amount was issued to the company on April 6, 1921. Recently it was discovered by the government officials that the other dollar had never been paid to the company, and the latter was notified that the money was still awaiting it and the execution of the document which would form the basis of the issuance of the government check was requested. The board of directors accordingly authorized the officers of the company to execute the document, and the company is now in receipt of the government's check.

Another Application for a Hydro-Electric Plant in Oklahoma. — An application has been filed with the Oklahoma Drainage Commission by Frederick and Devere Dierks, Kansas City lumbermen, seeking a permit to construct a hydro-electric power plant on the Mountain Fork River in McCurtain County costing approximately $5,000,000. The applicants now operate electric plants and transmission lines serving Broken Bow, Wright, Valliant and Idabel. The project will include construction of three separate dams to be 135, 185 and 35 ft. high respectively. The dams will create storage reservoirs covering approximately 80 square miles. The applicants are said to have sufficient financial backing and declare that they will start work immediately with probable completion of the project in five years.

Dispute Over Power in Winnipeg Settled.—The Winnipeg power case which threatened to prove the basis of a protracted action in the courts has been settled. The application to quash the civic bylaw validating the recent agreement entered into between the city of Winnipeg and the Winnipeg Electric Company has been withdrawn, costs having been awarded to the Winnipeg Electric Company, the Manitoba Power Company and the city of Winnipeg, who were joint defendants. The bylaw authorizes a contract with the Manitoba Power Company for the purchase of 30,000 hp. over a nine-year or eleven-year term and involving an expenditure of approximately $4,373,000. The application to quash the bylaw was based on its alleged contravention of the Manitoba statute guaranteeing to the civic hydro department the powers under which it operates.

Wireless Service Forges Ahead.—Wireless telephone service across the Atlantic between New York and London on a commercial basis was to be inaugurated on Friday, Jan. 7, by the American Telephone & Telegraph Company and the British Post Office. The charge will be $75 for a three-minute conversation or less and $25 for each additional minute. There will be a report charge of $10 if the telephone, but not the designated party, is reached. Coincident with this announcement it is given out that within a few weeks all parts of the British Empire will be linked together by a world-chain short-wave beam of wireless telegraphy similar to one recently instituted between England and Canada. This will be a government enterprise, and it is understood that charges for messages already have been fixed by the Post Office at about two-thirds of the cable rate.

Doubling Crops by Means of Electricity.—How electric light can be used to grow flowers and vegetables at twice their ordinary rate of growth and thus double crops at very little cost was demonstrated at Atlantic City recently by R. L. Zahour, illuminating engineer of the Westinghouse Lamp Company, before the New Jersey State Horticultural Society. A miniature greenhouse equipped with proper lighting and a number of Christmas plants were used by Mr. Zahour to explain his talk, which was also illustrated with photographs and charts covering a series of tests made by him over a period of two years. The greenhouse was to remain on view for two weeks. It has been found, according to Mr. Zahour, that the proper lighting installation consists of 500, 750 or 1,000-watt lamps in deep-bowl metal reflectors to concentrate the light directly on the plants. These should burn from 9 or 10 o'clock at night till 2 or 3 a.m.

Men of the Industry

Whitehead Goes to France

Dr. John B. Whitehead, professor of electrical engineering and dean of the School of Engineering at Johns Hopkins University in Baltimore, has been appointed exchange professor to France, where he will represent as international exchange professor in engineering and applied science not only his own university but Harvard, Yale, Columbia, Cornell, Pennsylvania and the Massachusetts Institute of Technology as well. His tentative program abroad includes a tour of seven of the leading universities of France, where he will give a series of lectures on dielectric theory and insulation. He

J. B. Whitehead

expects to visit the universities of Toulouse, Lyons, Grenoble, Lille and Strasbourg, as well as the Ecole Polytechnique and the Ecole Centrale in Paris.

Dr. Whitehead's lectures will be based on his pioneer work in the field of high-voltage insulation, carried on in the Johns Hopkins laboratories. Financial support for his experiments has been furnished by a number of electrical industries through the Engineering Foundation. His researches in this line received recognition in Europe when he was awarded the triennial prize of the George Montefiore Foundation, of Belgium, for the best original work in the technical application of electricity.

Professor Whitehead is chairman of the committee on research of the American Institute of Electrical Engineers, fellow of the same organization, chairman of the committee on electrical insulation of the National Research Council and member of the American Institute of Consulting Engineers.

W. E. Mitchell, vice-president in charge of operations of the Alabama Power Company, sailed for South America Jan. 8 to spend a short vacation there.

Irving E. Moultrop, chief engineer of the Edison Electric Illuminating Company of Boston, received on Dec. 31 a diamond and gold service pin from that company upon completing 35 years with the organization. Employees of the construction bureau presented him with a Hamilton wrist watch, and bureau and department heads in the operating bureau gave him a Telechron clock.

L. L. Elden Receives New Appointment

Leonard L. Elden, for many years superintendent of the electrical engineering department of the Edison Electric Illuminating Company of Boston, has been appointed technical adviser to the superintendent of the company's operating bureau. **A. H. Sweetnam,** assistant superintendent of the electrical engineering department, becomes superintendent to succeed Mr. Elden.

General Electric Names New Vice-Presidents

Theodore Beran, formerly manager of the New York district of the General Electric Company, was elected a commercial vice-president of the company at a meeting of the directors held last week. Mr. Beran has been manager of this district since 1903 and has been with the company since its foundation. J. A. Cranston, of the Pacific Coast district, and H. L. Monroe, of the Chicago territory, were also elected commercial vice-presidents. E. W. Allen, formerly manager of engineering, was elected a vice-president in charge of that activity. Mr. Allen will continue his office at Schenectady. G. E. Emmons, who was in charge of the manufacturing organization from 1916 until he announced his retirement in 1924, was elected acting-vice-president on account of the illness of F. C. Pratt.

Gerard Swope, president of the General Electric Company, sailed for Europe aboard the Lloyd Sabaudo liner *Conte Biancamano* Jan. 5 for a short sojourn in Italy. Mr. Swope will visit Gibraltar, Genoa and Naples.

Edward N. Hurley, chairman of the executive committee of the Electric Household Utilities Corporation, has been elected a director of the Studebaker Corporation.

E. W. Rockafellow, who is well known in electrical circles as a former leader in the jobbing branch of the industry, has been appointed manager of the Eastern sales office of the MacGillis & Gibbs Company of Milwaukee, with headquarters in New York. Mr. Rockafellow had been identified with the Western Electric Company from the early days of the electrical industry until the spring of 1923, when he resigned as general supply sales manager to become a vice-president of the National Pole Company in charge of sales. He was one of the organizers of the Electrical Supply Jobbers' Association and the Society for Electrical Development and has been a member of many committees of the National Electric Light Association.

P. F. Sellers New Vice-President in Buffalo

Paulding F. Sellers, who was recently elected vice-president in charge of operations of the Buffalo General Electric Company, will soon complete 30 years of continuous service with that institution. Mr. Sellers was born in San Antonio, Tex., where his father commanded a United States Army post. He was educated at Trinity Military School and at Pennsylvania State College, from which he was graduated in 1897 with the degree of electrical engineer.

Mr. Sellers joined the Buffalo General Electric Company staff on Aug. 3, 1897, as a lineman's helper. In 1901 he was appointed engineer, succeeding the late H. G. Stott, who removed to New York City as chief engineer of the Manhattan Railway, now the Inter-

P. F. Sellers

borough Railway. Mr. Sellers' progress with the Buffalo General Electric Company has been steady. From engineer he advanced to the position of assistant superintendent, then to general superintendent, and now to his new office.

Obituary

Nathaniel H. Stone, a director of the El Paso (Tex.) Electric Company and of the Puget Sound Power & Light Company and long a member of the banking house of J. M. Forbes & Company, Boston, was killed recently at North Easton, Mass., in an automobile accident. He was born at New Bedford, Mass., in 1853.

Albert K. Young, new-business manager of the Toledo Edison Company, died of pneumonia at his home in Toledo, Ohio, Dec. 27. Mr. Young, who was 44 years of age, had been new-business manager of the Toledo company for the last thirteen years. He entered the service of the Doherty organization at Cincinnati in 1906, having served as special new-business representative at Montgomery, Ala., and becoming new-business manager of the Toledo Railway & Light Company in December, 1913, which position he retained until his death. Mr. Young was prominent in Toledo business circles and an active member of many local and national electric associations.

Commission Rulings

Commission Regards Dividend on Investment Rather than Rate per Cent in Authorizing Change in Stock Issue.—Authorizing the Northern Indiana Public Service Company to issue $1,000,000 par value of 6 per cent stock on an 86 per cent basis rather than $1,000,000 par value of 7 per cent stock on a 90 per cent basis, the Indiana Public Service Commission pointed out that the dividend on the former issue would be $7.77 annually per share, while that on the latter issue would be only $6.97 per share. Actual rate of return to stockholders rather than percentage of return on par value of shares was held by the commission to be the governing consideration.

Not the Province of Commission to Advise or Discourage Sale of Municipal Plant.—When the city of Fort Atkinson, Wis., made a preliminary agreement with the Wisconsin Gas & Electric Company for the sale of its municipal plant at a stated price, the Wisconsin Railroad Commission approved the sale price, but said that in making such determination it was following what it believed to be its duty under the statute and would not express an opinion as to the advisability or inadvisability of the proposed sale, that being a matter of public policy for the determination of the people of the city by referendum as provided by statute. In other words, explained the commission, the finding was merely to the effect that if the people desired to sell their public utility properties, the terms of the preliminary agreement would afford the city a fair compensation.

Notice to Delinquent Utility Customer Before Cutting Off Service Insisted On.—A rule of the Mountain States Telephone & Telegraph Company providing for the disconnection of a delinquent without giving him notice that he is in arrears has been held to be unreasonable by the Public Service Commission of Utah. Conceding that a rule which precludes patrons from obtaining service without paying for it inures to the benefit of the utility and its paying patrons alike, the commission held that such a rule should not be so construed as to permit the utility to work unnecessary hardships upon patrons in arrears. To the extent to which it may occasion well-meaning patrons unnecessary embarrassments and financial losses, it is unreasonable and oppressive. The company contended that as payment was required in advance the subscriber would know whether he had paid his bill and, therefore, there was no necessity for notice. The commission replied that, from the standpoint of business, the rule contended for by the company might be reasonable when applied to a subscriber who might be inclined to beat the utility out of pay for its service. As applied to the well-meaning subscriber who fully intends to pay and is unconscious of the fact that he is in arrears, such a rule is not only unreasonable but is pernicious in its effect when applied.

Accrued Depreciation Approved by I. C. C. as Against Retirement Depreciation.—While the provisions of Interstate Commerce Commission decisions do not directly affect state-controlled public utility companies, these companies have a vital interest in I. C. C. orders such as one on depreciation charges recently handed down to govern interstate telephone and railroad companies. This decision, contrary to the expressed views of the National Electric Light Association, the National Gas Association, the National Association of Railroad and Public Utilities Commissioners and others concerned in the regulation of utilites, approved the principle of accrued depreciation as against the principle of retirement depreciation. The rules laid down by the Interstate Commerce Commission read in part:

(1) We therefore find that depreciation is the loss in service value not restored by current maintenance other than extraordinary repairs, as defined in finding (2) infra, and incurred in connection with the consumption or prospective retirement of property in the course of service from causes against which the carrier is not protected by insurance, which are known to be in current operation, and whose effect can be forecast with a reasonable approach to accuracy.

(2) That the term "extraordinary repairs" shall, for the purposes of this finding, be construed to mean repairs involving renewals of substantial portions of a unit of property which are made in connection with the reconstruction or restoration of the unit or which involve renewals of longitudinal sections of continuous structures or the replacement of parts of such structures of a particular type by the substitution of parts of an improved type or design.

That the term "service life" shall be construed to mean:

(a) In the case of units of property which are ultimately retired as units and which are not subject to extraordinary repairs, the estimated period of time between the installation of the unit in question and its prospective retirement.

(b) In the case of units of property which are not ultimately retired as units but are continued in service indefinitely by extraordinary repairs, the estimated average period of time between the installation of the sections or parts of the unit in question which are renewed from time to time by the extraordinary repairs and their prospective retirements.

(c) In the case of units of property which are ultimately retired as units but have their period of service prolonged by extraordinary repairs, the estimated period of time between the installation of the unit and its prospective retirement as a unit.

That the term "net salvage value" shall be construed to mean the amount received for property retired and disposed of, or the amount representing the second-hand value if suitable for reuse, after deducting the cost of removing the property and of recovering the salvage. In cases where the cost of removal and recovery is greater than the value of the material recovered, "net salvage value" may be a minus quantity.

That the term "service value" shall be construed to mean:

(a) In the case of units of property which are ultimately retired as units and which are not subject to extraordinary repairs, the difference between the ledger value of the unit and its estimated net salvage value at the time of prospective retirement.

(b) In the case of units of property which are not ultimately retired as units but are continued in service indefinitely by extraordinary repairs, the difference between the ledger value of the unit and the estimated net salvage value of materials recovered in connection with the extraordinary repairs.

(c) In the case of units of property which are ultimately retired as units but have their period of service prolonged by extraordinary repairs, the difference between the ledger value of the unit and the estimated net salvage value at the time of prospective retirement plus the estimated cost of extraordinary repairs intervening between installation and retirement after deducting the estimated net salvage value of materials recovered in connection with such repairs.

That the total expense of depreciation is connection with any unit of property is its service value determined as above provided.

(3) We therefore find that annual depreciation charges shall be computed at such percentage rate of the ledger value of the unit of property in question that the service value, as hereinbefore defined, may be distributed under the straight-line method in equal annual charges to operating expenses during the estimated service life of the unit.

Recent Court Decisions

Light and Power Company Found Guilty of Breach of Oral Contract to Furnish Motor for Irrigation.—The Supreme Court of Arkansas, reversing an instructed verdict for the defendant in Beeble vs. Arkansas Light & Power Company, found that the company had broken an oral contract to furnish a proper motor for irrigating rice fields, thereby causing the loss of the greater part of the crop. The court found that the company refused to rely upon the representations made by the agent of the plantiffs concerning the conditions and situation existing upon the farm and made its own calculations as to the size and character of the motor needed, after a personal inspection. It also found that the plantiffs relied upon the promise of the company that it would install a motor of the size and character necessary to irrigate the crop, and that the defective or wrong character of the motors first supplied and the delay in substituting a suitable one made the defendant responsible for damages. (287 S. W. 766.)*

Whether Grasping Charged Telephone Wire to Remove It from House Is Ordinary Care Question for Jury.—In Bricker vs. City of Troy the Supreme Court of Missouri affirmed a verdict for the plaintiff in a damage suit because of the death of a man who, fearing his house would catch fire, grasped a telephone wire which had become heavily charged, as alleged, by contact with the city's street-lighting wires. The question whether with the telephone bell ringing and smoke issuing from its box a man of ordinary care would have tried to remove the wire was held to have been rightly submitted to the jury, as had been the question of negligence in operating the light plant by the city after officials knew or should have known that electricity was escaping over the telephone wires. An instruction directing a verdict for the plaintiff, on affirmation of purported facts, was not erroneous in not requiring a finding that the deceased had no notice that the telephone wire was charged, that matter relating solely to the defense of contributory negligence. Nor was there anything prejudicial to defendant in an instruction that the jury might take into consideration the victim's solicitude for his property. (287 S.W. 341.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Financial and Corporate

Utility Offerings Exceed Demand

Active Buying Has Not Yet Commenced —Few Price Changes Recorded in Power and Light List

THE reactionary influence apparent in the security markets is being felt by power and light stocks in heavy offerings of certain classes of stock and indifferent demand. There is a tendency to postpone commitments until a more decided position is taken by the market and until more dependable signals of the coming year's business trend are apparent. As a result, the volume of buying is small and few important price changes have taken place. There is a fairly general impression, however, that the slackness is merely a temporary post-holiday situation.

Common stocks, on the average, stand at about the same level as that of the last two weeks of the year. The average of twenty representative common issues compiled by ELECTRICAL WORLD stands at 95, which was the average figure for the two closing weeks of December. This compares with an average of 90 for the same group at the beginning of last year and a low for the year of 86, in April.

Preferred stocks have continued firm, although offerings have tended to exceed demand. No outstanding changes are recorded.

Demand for power and light bonds has been keener during the past few weeks. The supply of first mortgage bonds of such companies has been short of requirements, and most issues are selling above par, which represents a yield below 5 per cent. Offerings even of first and refunding issues are relatively limited.

Electric Bond & Share to Double Capital Stock

Directors of the Electric Bond & Share Company have voted to submit for consideration of the stockholders at a special meeting to be held on Jan. 21 the matter of increasing the authorized capital stock of the company from $50,000,000 to $100,000,000 by the authorization of an additional $50,000,000 of stock, to be divided into 500,000 shares of the par value of $100 each, of which 250,000 shares will be preferred stock and 250,000 shares common stock.

Subject to such increase being effected, 150,000 shares of the preferred stock have been sold at a substantial premium, and (in order to comply with the provisions of the certificate of incorporation of the company that its outstanding preferred stock shall at no time be so increased as to exceed its outstanding common stock) a stock dividend of 150,000 shares of the increased common stock at par has been declared on the common stock. This dividend will be paid to the Electric Bond & Share Securities Corporation, the owner of all of the common stock of the Electric Bond & Share Company.

The notice to the stockholders calling the special meeting states that the directors of the company are of the opinion that the larger employment of the company's technical and financial staffs in a more diversified territory will be to the company's advantage, particularly in connection with the supervision and financing of hydro-electric and other power situations in foreign countries. The letter states that the capital required by the company at the present time is large and must be constantly increased to meet the unusually rapid growth of the electric power business.

Light and Power Maturities $56,000,000 in 1927

Public utility corporation bonds and notes falling due in 1927 aggregate $280,413,870, and of this total $56,042,480 represents electric light and power maturities.

Customer Sales Reach $16,443,000 in October

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to their customers and employees, it is estimated that during October a total of 193,740 shares were sold in this manner. The value of the stock sold is estimated at $16,443,000. A total of 26,800 customers took part in the sales during October.

Niagara Electric Service Increases Shares.—Niagara Electric Service Corporation, Niagara Falls, N. Y., has filed a certificate in the office of the Secretary of State increasing its number of shares from 25,000 of $100 par value to 60,000 of non-par value.

Republic Railway & Light Meeting Called.—Shareholders of the Republic Railway & Light Company will meet Feb. 15 to approve dissolution of the company in accordance with the plan to simplify the capital structure of the Penn-Ohio Edison Company discussed in the Nov. 13 issue of the ELECTRICAL WORLD.

LIGHT AND POWER BONDS AND NOTES FALLING DUE IN 1927

Due	Corporation	Rate	Amount
JANUARY			
Jan. 1	Columbia G. & El., 1st...	5	$8,255,500
Jan. 1	Columbia G. & El., deb...	5	2,588,140
Jan. 1	Cataract Pwr. & Con., 1st	5	574,000
Jan. 1	Central Ill. Pub. Sew., ser.	5	400,000
Jan. 1	Sachsen-Anhalt El., ser...	6½	250,000
Jan. 15	So. California Edison, ser.	7	1,000,000
January total			$13,067,640
FEBRUARY			
Feb. 1	New Eng. Pwr., 3-yr.	6	$1,800,000
Feb. 1	Pwr. Corp. of N. Y., 3-yr.	6½	1,000,000
February total			$2,800,000
MARCH			
Mar. 1	Cen. Indiana Pwr., 3-yr.	7	$6,500,000
Mar. 1	Cen. Indiana Pwr., 3-yr.	5½	1,500,000
Mar. 1	Union Edison of Del., 1-yr.	5	800,000
Mar. 1	Grand Junction El. Gas & Mfg., 1st	5	250,000
Mar. 1	New Castle Elec., 1st	5	200,000
Mar. 1	Vermont Pwr. & Ltg., 1st.	5	200,000
March total			$9,450,000
APRIL			
Apr. 1	Nevada-Cal. Power, 1st...	6	$1,289,000
Apr. 1	Cen. Ill. Pub. Serv., ser.	5	400,000
Apr. 1	Kentucky Cen. El., 1-yr.B	6	335,000
Apr. 1	York Light & Heat, 1st...	5	311,500
Apr. 1	New London G. & El., 1st	5	276,500
April total			$2,612,000
MAY			
May 1	Blue Ridge Power, 1-yr...	6	$500,000
May 1	Northes't Iowa Pwr., 1-yr.	5	300,000
May 1	Cen. Indiana Ltg., ref.	5	285,500
May 1	Niagara Lt., Ht. & P., 1st	5	250,000
May 31	City Light & Trac., 1-yr..	5	700,000
May total			$2,035,500
JUNE			
June 1	Gal.-Houston El., 2-yr.	7	$1,200,000
June 1	Manufacturers Pwr., 2-yr.	6	900,000
June 1	People's Lt. & Pwr., serial	5½	350,000
June 1	Bloom. & Normal Ry. El. & Ht., 1st	5	307,000
June 1	Sterling G. & El. Lt., 1st	5	241,500
June 2	Calumet Power, 1st.	6	500,000
June total			$3,498,500
JULY			
July 1	Gen. Pwr. & Light, 1-yr..	6	$1,000,000
July 1	Houghton Cy. El. Lt., 1st	5	787,000
July 1	Cen. Ill. Pub. Serv., ser...	5	400,000
July 1	Sachsen-Anhalt El., ser...	6½	250,000
July total			$2,937,000
AUGUST			
Aug. 1	Missouri-Ed. Elec., cons..	5	$3,168,000
August total			$3,168,000
SEPTEMBER			
Sept. 1	Summit County Pwr., 1st	6	$333,000
September total			$333,000
OCTOBER			
Oct. 1	Com. Lt. & Pwr., 1-yr...	6	$2,000,000
Oct. 1	Nassau Lt. & Pwr., 1st...	5	756,000
Oct. 1	Cen. Ill. Pub. Serv., ser...	5	400,000
October total			$3,156,000
NOVEMBER			
Nov. 1	Con. Gas. & Elec., clt....	5	$3,934,100
Nov. 1	Sacramento El., G. & Ry., cons.	5	1,557,000
Nov. 1	Midland Utilities, serial...	5	1,000,000
Nov. 15	Texas-Louisiana Pwr., 1-yr.	6	600,000
November total			$7,091,100
DECEMBER			
Dec. 1	Georgia L., P & Rys., 3-yr.	6	$2,500,000
Dec. 1	Columbus El. & Pr., 3-yr.	5	2,000,000
Dec. 15	Peoples Lt. & Pwr., ser...	5½	500,000
Dec. 15	Peoples Lt. & Pwr., serial	5½	450,000
Dec. 31	Keystone Pub. Serv., gtd.	6	443,740
December total			$5,893,740

Electric light and power bonds and notes maturing in:

January	$13,067,640	July	$2,937,000
February	2,800,000	August	3,168,000
March	9,450,000	September	333,000
April	2,612,000	October	3,156,000
May	2,035,500	November	7,091,100
June	3,498,500	December	5,893,740

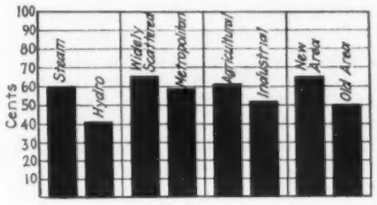
Electric light and power issues maturing in 1927 ..... $56,042,480

Operating Ratio a Variable Yardstick

Meaningless and Misleading if Applied Indiscriminately to Public Utilities Operating Under Different Conditions—Varies with Price Levels

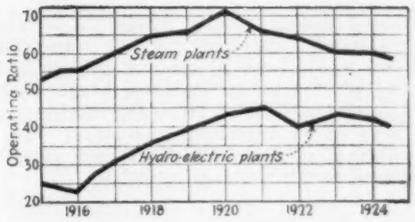
WHAT should be the operating ratio of a successful power and light company? What proportion of every dollar of gross revenue should go toward costs of operation? The answer depends entirely on the type of plant and the circumstances under which it operates.

A study of the operating ratios in a large group of representative power



OPERATING RATIO VARIES WITH WORKING CONDITION

and light companies throughout the United States presents a classification of operating costs valuable to the investor and to any one seeking to measure the progress of a particular company or to compare one company with another. Ten representative steam plants, for example, had an average operating ratio of 61 per cent; ten hydro plants showed an average of 40 per cent, and ten companies operating both steam and hydro plants had a combined average of 54 per cent. Out of every dollar of gross revenue, in other words, steam-plant operation required 61 cents and hydro-electric plant operation only 40 cents. Variation in original costs as between steam and hydro plants, of course, does not enter the present discussion. Ratios for the three groups are given in the table below.



TREND OF OPERATING RATIO FOR TEN-YEAR PERIOD

In addition to the variation between steam and hydro operation there are other variable factors. A company generating its own power would not have the same operating ratio as a wholesale purchaser of power. A plant operating in a metropolitan area

Steam Plants	Per Cent
Public Service of New Jersey	53
Philadelphia Electric	61
New York Edison	77
Commonwealth Edison	64
Cleveland Electric Illuminating	52
Illinois Power & Light	64
Duquesne Light	55
Narragansett Electric Light	64
West Penn Power	56
Oklahoma Gas & Electric	65
	611
Average	61

Hydro Plants	Per Cent
Niagara Falls Power	33
Washington Water Power	40
Pacific Gas & Electric	51
Southern California Edison	33
Mississippi River Power	26
Montana Power	30
Cumberland County Power & Light	51

Hydro Plants	Per Cent
Great Western Power	32
San Joaquin Light & Power	44
Puget Sound Power & Light	62
	402
Average	40

Combination Hydro and Steam Plants	Per Cent
Tennessee Electric Power	56
Consumers Power	54
Alabama Power	49
Appalachian Power	48
Carolina Power & Light	54
Connecticut Light & Power	59
Hartford Electric Light	56
Adirondack Power & Light	58
Columbus (Ga.) Electric & Power	54
Utah Power & Light	49
	537
Average	54

Security Issues of Electric Service Companies in December

Name of Company	Amount of Issue	Period Years	Class	Purposes	Interest Rate	Price	Per Cent Yield
Electric Public Service Co.	$850,000	10	Sinking fund gold debenture bonds	To provide funds for acquisition of additional property and for general corporate purposes	6	95	6.68
Binghamton Light, Heat & Pwr. Co.	1,450,000	20	First refunding mortgage gold bonds	Construction	5	100	5
Otter Tail Power Co.	1,300,000	20	General mortgage gold bonds, series E	Construction	5	98½	5.12
Oswego River Power Corp.	3,500,000	5	Gold debentures	To reimburse company in part for the acquisition and construction of certain of its properties	6	100	6
Central Public Service Co.	750,000	14	Collateral trust gold bonds, series A		6	92	6.30
Caribou Water, Light & Power Co.	100,000	1	Coupon notes	Construction	6	100	6
Central West Public Service Co.	1,800,000	10	Convertible debentures	To retire funded indebtedness, to acquire new properties, for additional working capital and for other corporate purposes	6	97½	6.35
Colorado Central Power Co.	850,000	20	First mortgage sinking fund gold bonds, series A	To acquire new properties and for general corporate purposes	5½	96	5.83
Associated Gas & Electric Co.	9,550,000	..	Cumulative preferred stock	Retire certain indebtedness	6½	95½	6.80
Minnesota Power & Light Co.	2,700,000	29	Additional first and refunding mortgage gold bonds		5	99	5.05
Virginia Electric & Power Co.	6,000,000	29	Additional first and refunding mortgage gold bonds, A	Proceeds will be applied toward retirement of floating debt and to provide for construction requirements	5	96½	5.23
Interstate Public Service Co.	10,000,000	30	First mortgage and refunding gold bonds, series D	To reimburse for refunding, additions and extensions to its property and for other corporate purposes	5	96	5.25
Illinois Power & Light Corp.	7,500,000	30	First and refunding mortgage gold bonds, series C		5	97	5.20
New Jersey Power & Light Co.	2,350,000	..	Cumulative preferred stock	To retire stock and for other corporate purposes	6	94	6.38
Standard Gas & Electric Co.	10,000,000	..	Gold debentures	To reimburse company for expenditure made and indebtedness incurred for the acquisition of additional securities and for other corporate purposes	6	99	6.06
Niagara, Lockport & Ontario Pwr. Co.	3,750,000	29	First mortgage and refunding gold bonds, series A	To reimburse for expenditures for additions and extensions and for the purchase of underlying bonds	5	100	5
Central West Public Service Co.	4,000,000	30	First lien collateral gold bonds, series A	To retire funded indebtedness, to acquire new properties, additional working capital and for other corporate purposes	5½	99	5.55
Central Power & Light Co.	1,750,000	..	Cumulative preferred stock		7	101¼	6.89
Iowa Railway & Lt. Corp.	550,000	20	First and refunding mortgage gold bonds, series B	Additions, extensions and for the purchase of additional properties	5	97¼	5.20
New Jersey Power & Light Co.	6,000,000	30	First mortgage gold bonds	Recapitalization and for construction	5	99	5.06
Total	$74,750,000						

would differ from a group of widely scattered units. One serving industrial load would have a different ratio from one serving an agricultural area. Both these would differ from one serving a large single industry, and so on. The study of groups of each of such plants presents the following ratios:

	Operating Ratio Per Cent
Group of steam plants	53
Group of hydro plants	34
Group of widely scattered systems	65
Group of metropolitan systems	58
Group of plants serving agricultural areas	61
Group of plants serving industrial load	54
Group of plants serving one large industry	37

Considering next such groups of plants over a period of years, a study made recently showed steam and hydro plants, respectively, to have the following average ratios:

	Per Cent Steam Plants	Per Cent Hydro Plants		Per Cent Steam Plants	Per Cent Hydro Plants
1915	54	25	1920	72	43
1916	56	24	1921	67	45
1917	63	33	1922	64	41
1918	66	38	1923	63	43
1919	67	39	1924	62	42

It will be noted that the ratio showed an upward trend until 1920-21 and has since shown a more or less steady decline. Factors contributing toward this trend are rising costs of labor and materials during and after the war, declining prices since about 1921, some rate increases during the first part of the period and some declines more recently, a gradual improvement in technique, economies effected by interconnection and a gradual rise in the volume of business.

The conclusions to be drawn from the above are that there is a relatively fixed operating ratio in each comparable class of utilities, but that the indiscriminate application of the ratio to companies operating under different conditions presents a false picture. The operating ratio shows how effectively costs are being controlled in relation to aggregate sales. There may easily be cases in which insufficient business may result in net earnings inadequate to take care of fixed charges while the ratio is reasonably low. On the other hand, there may be cases in which the total investment is small in relation to the volume of business, and satisfactory results may be obtained while the operating ratio is apparently too high. But if these various factors be taken account of, the operating ratio is one of the most valuable of yardsticks.

New Capital Issue

A ten-million-dollar loan was floated by the International Power Securities Corporation during the past week in the form of 7 per cent secured gold bonds, series E, priced at 96⅜ and interest, to yield 7.30 per cent. These bonds dated Feb. 1, 1927, and maturing Feb. 1, 1957, will be direct obligations of the International Power Securities Corporation and will be secured by a mortgage made to the trustee by the Società Generale Italiana Edison di Elettricità (Edison General Italian Electric Company) and two of its subsidiaries.

The International Power Securities Corporation was organized in 1923 by prominent American interests primarily to acquire carefully selected securities and obligations of leading electric light and power companies operating in the United States of America or in foreign countries.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 4	Low 1926	High 1926
ABITIBI PWR. & PAPER, com. —no par	k 86	70¼	98
Adirondack Pwr. & Lt.—7% pf.	103½	....	....
Adirondack Pwr. & Lt.—8% pf.	110	....	....
Ala. Pwr., pf.	107½	....	....
Allis-Chalmers Mfg. pf.	110½	105	111½
Allis-Chalmers Mfg., com.	89	78½	94½
Aluminum Co. of Amer., com.	71	54½	76
Aluminum Co. of Amer. pf.	102	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	89	79	98
Amer. & Foreign Pwr., com.—no par	21½	14½	42½
Amer. Bosch Magneto, com.—no par	16½	16	34½
Amer. Brown Boveri, Elec.	39½	30½	50
Amer. Brown Boveri, Elec., pf.	k 96	86½	97½
Amer. Gas & Elec., 6% pf.—no par.	96½	90½	97½
Amer. Gas & Elec., com.—no par.	99½	64	111½
Amer. Lt. & Trac., 6% pf.	114	105	134
Amer. Lt. & Trac., com.	229	193	263
Amer. Pwr. & Lt., 6% pf.	98½	92	99½
Amer. Pwr. & Lt., com.—no par.	m235½	50½	72½
Amer. Pub. Serv., 7% pf.	k 96	92	97½
Amer. Pub. Serv., com.	k 50	45	80
Amer. Pub. Utilities, 7% pfc. pf.	75	....	....
Amer. Pub. Utilities, 7% pr. pf.	86	....	....
Amer. Pub. Utilities, com.	m 66	....	....
Amer. States Sec., A	3½	....	....
Amer. States Sec. B	3½	....	....
Amer. Superpwr. pf.—25	26½	23	27½
Amer. Superpower, pf.	k 94½	....	....
Amer. Superpwr., Class A—no par.	k 28	19½	37½
Amer. Superpwr., Class B—no par.	28	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	106	101½	108½
Amer. Wtr Wks. & Elec., com.—20	65½	45½	74
Anaconda Copper	48	41½	51½
Appalachian Elec. Pwr., 7% pf.	k 99	90	101
Appalachian Ele. Pwr., 1st pf., 7%	m 98	....	....
Appalachian Elec. Pwr., com.	m 78	....	....
Arizona Pwr., 7% pf.	k 72	60	82*
Arizona Pwr., com.	22	19	35½
Arkansas Cent. Pwr., pf., $7—no par	k100	99	107
Arkansas Lt. & Pwr., 7% pf. no par	102	....	....
Arkansas Lt. & Pwr., com.—no par	k100	110	115
Asheville Pwr. & Lt., 7% pf.—no par	l107	107*	107*
Assoc. G. & E., pf.—$3.50—50	50½	....	....
Assoc. Gas & Elec., pf.—$6—no par	86½	....	....
Assoc. Gas & Elec., Class A—no par	35½	25½	38½
BABCOCK & WILCOX, com.	115	....	....
Binghamton Lt., Ht. & Pwr., pf.	k 91	90	95
Birmingham Elec. pf.—$7—no par.	106	....	....
Blackstone Valley Gas & Elec., pf.	k103	103	106
Blackstone Valley G.&E., com.—50	k100	100½	106
Blaw-Knox, com.	f 70½	....	....
Brazilian Trac., Lt. & Pwr., com.	f104½	....	....
Broad River Pwr., pf.	95½	....	....
Brooklyn Edison, com.	154	133	163
Buffalo, Niagara&East Pwr.,pf.—25.	k 24	22½	26
Buffalo, Niagara & Eastern Pwr., com.—no par.	27½	23½	38½
CALIFORNIA ELEC. GENERATING, pf.	93	92	95
California Ry. & Pwr., pf.	k125	f 88	130
Carolina Pwr. & Lt., pf.—$7—no par	107½	....	....
Cent. & S. W. Ut. 7% pf.—no par	x 93½	89½	96½
Cent. & S. W. Ut., pr. in. pf.—no par	a 99	93	100
Central Ariz. Lt. & Pwr., pf.	105	....	....
Central Ark. Ry. & Lt., 7% pf.	101	....	....
Central Ill. Pub. Serv., 6% pf.	k 89	89	91
Central Ind. Pwr., 7% pf.	k 85	84½	95½
Central Pwr. & Lt., pf.	100	....	....
Central States Elec., 7% pf.	90	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	m117	110	117
Chicago Fuse Mfg., com., no par.	a 30½	30	35
Cincinnati Gas & Elec., com.	g 94	....	....
Cities Service, 6% pf.	l 91½	82½	92½
Cities Service, pf.B—10.	l 8½	7	8½
Cities Service, pf. BB—100.	l 82½	....	....
Cities Service, com.—20	l 50½	37½	50
Cities Service, Bks. Shs.—10.	l 25	19	25½
Clarion River Pwr., pf.	k 95	93	95
Cleveland Elec. Illg., 6% pf.	108	....	....
Cleveland Elec., Illg., com.	300	....	....
Colorado Pwr., 7% pf.	k 95	96	97
Columbia Gas & Elec., 7% pf.	116½	111½	117½
Columbia Gas & E., com.—no par.	89½	85½	91
Columbia Ry., Gas & Elec., 6% pf.	k 94	f 65	96
Columbus Elec. & Pwr., 2d pf.	103	....	....
Columbus Elec. & Pwr., new com.	55	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	98	....	....
Columbus Ry., Pwr. & Lt., pf. B.	95	....	....
Col. Ry., Pwr. & Lt., com.—no par.	70	....	....
Commonwealth Edison, com.	a139	....	....
Commonwealth Pwr., 6% pf.	92½	82	93½
Commonwealth Pwr., com—no par.	43½	28½	43½
Conn. Lt. & Pwr., 8% pf.	k119	117	121
Conn. Lt. & Pwr., 7% pf.	112	....	....
Cons. Gas of N. Y., pf.—50.	60	....	....
Cons. Gas of N.Y., com.—no par.	109	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	k105	102	107
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	e111	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	e113½	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	e126	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	e 51½	....	....
Cons. Pwr. & Lt., 7% pf.	106	....	....
Consumers Pwr., 6% pf.	100	....	....
Consumers Pwr., 6.6% pf.	103	....	....
Continental Gas & Elec., 7% pfc. pf.	103	....	....
Continental Gas & Elec., 7% pr. pf.	98½	....	....
Continental G.&E., com.—no par.	k195	85	210
Crocker Wheeler, com.	26	....	....
Crocker Wheeler, pf.	65	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	100	....	....
Detroit Edison, com.	k135	123½	141½
Dubilier Condenser com.—no par.	k 4½	3½	11
Dubuque Elec., 6% pf.	k 93	93	98½
Duquesne Lt., 7% pf.	k115	111	116½
EAST. N. Y. UTIL. pf.	k101	80	104
Eastern New York Util., com.	k 65	70	75
Eastern States Power.	10	....	....
Eastern States Power, pf.	93	....	....
Eastern Tex. Elec., 7% pf.	105	....	....
East. Tex. Elec., com.—no par.	k 75	70	80
Edison Elec. Illum. of Boston, com.	f225	....	....
E. Paso Elec., com.—no par.	k 90	70	94
E. Paso Elec. pf.	102	....	....
Elec. Bond & Share, 6% pf.	l108	108½*	109*
E. Bd. & Share Sec., com.—no par.	l 72	70½*	72½*
El. Household Util.	a 14	11½	25
Elec. Investors, 6% pf.—no par.	92½	....	....
Elec. Investors, com.—no par.	36	30½	74½
Elec. Investors, 10% pd. receipts.	k 20	12	56
Elec. Pwr & Lt., etfs, pf.	96½	89½	98½
Elec. Pwr. & Lt., etfs., 40% pd.	k104½	99½	115
Elec. Pwr. & Lt., etfs. full pd.	k104	102½	110½
Elec. Pwr. & Lt., etfs., com—no par.	18½	15½	34½
Elec. Refrig.	35½	33½	78½
Elec. Ry. Securities, com.—no par.	m 5½	4½	10
Elec. Storage Battery, com.—no par.	78½	71½	94½
Elmira Wtr., Lt. & R. R., 7% pf.	k 99½	97½	101½
Emerson Elec., pf.	m105	101	105
Empire Power, A.	27	....	....
Engr. Pub. Serv., pf.—no par.	m 94	92½	96½
Engr. Pub. Serv., com.—no par.	22½	19½	24½
Eureka Vac. Cleaner, com.—no par.	67½	43	68½
FAIRBANKS MORSE, pf.	108	106½	115
Fairbanks Morse, com.—no par.	39½	37½	59½
Federal Lt. & Trac., com.	41½	28	47½
Federal Light & Traction, pf.	k 93	86	94
Federal Utilities, pf.	m 70	....	....
Federal Utilities, com.	m 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	l 109	109*	112*
GALVESTON-HOUSTON ELEC., 6% pf.	67	....	....
Galveston-Hstn. El., com.	25	....	....
Gen. Elec., com.	83½	79	95½
Gen. Elec. special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	x 43	34	59
Gen. G.&E., (Del.) com. B no par.	m 42	36	48½
Gen. G.&E., (Del.) A pf. $8 no par.	k112	105½	113
Gen. G.&E., (Del.) A pf. $7 no par.	k 98½	95	100
Gen. G.&E., (Del.) pf. B.	k 94½	92½	96
General Public Service, pf.	m103	100	106
General Public Service, com.	k 11½	11	16½
Ga. Lt., Pwr., & Rys., 6% pf.	m 88	82	98
Ga. Lt., Pwr. & Rys., com.	m 60	65	80
Ga. Ry. & Power, 8% pf.	k118	112	122
Ga. Ry. & Power, 7% pf.	105½	....	....
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	h103½	101	105
IDAHO PWR., 7% pf.	104	....	....
Ill No. Utilities, 6% pf.	k 88	88	92
Ill. Pwr. & Lt., 7% pf.	98½	....	....
Ingersoll Rand	94	80½	105
Int. Combus. Engr., com.—no par	48½	33½	64½
Int. Utilities, class A—no par.	k 29½	24	39
Int. Utilities, class B—no par.	k 3½	3½	9½
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	k 97½	96½	99
Iowa Ry. & Lt., 7% pf.	k 96	98	100
JERSEY CENTRAL PWR. & LT., 7% pf.	97	....	....
Jersey Central Pwr. & Lt., ptc., pf.	k107	95½	112
Jersey Central Pwr. & Lt., com.—no par	k 25	25	50½
Johns-Manville, com.—no par.	217	130	220

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high. Friday, Dec. 31. lBid, low, high, Wednesday, Jan. 5. mLatest quotations available. *1927.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Jan. 4	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf.	*k*113	107½	115
Kansas Gas & Elec., 7% pf.	*l*102½	102*	103½*
Kentucky Hydro-Elec., pf.	*m* 94½	91½	95½
Kentucky Sec., 6% pf.	82	....	....
Kentucky Sec., com.	*k*108	90	108
Kentucky Utilities, 6% pf.	*k* 95	90	96½
Keystone Pwr. & Lt. 7% pf.	*k* 97	95	98½
LA CLEDE GAS LT., com.	*k*180	146	196½
Lehigh Pwr. Sec., com.—no par	15½	10	22
Long Island Ltg., 7% pf.	110	....	....
Long Island Ltg., com.—no par	*k*130	120	150
Los Angeles Gas & Elec., 6% pf.	98½	....	....
Louisville Gas & Elec., Class. A	24	22½	26½
MANHATTAN ELEC. SUPPLY.	57½	44	87½
Manila Elec., com.—no par	*k* 38	27½	45½
Maytag Mfg. *com.	*k* 23½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	*k*108	103	110
Metro. Edison, pf.—$6—no par	94	....	....
Metropolitan Edison, pf., $7, no par	103	....	....
Metropolitan Edison, com., no par	*k* 60	45	60
Middle West Utilities, 7% pf.	*a*105½	....	....
Middle West Utilities, 7% pr. lien pf	*a*118	....	....
Middle West Utilities, com.—no par	*a*111	....	....
Midland Utilities, pr. ln. pf.	*a* 98	....	....
Midland Utilities pf. A	*a* 97	....	....
Milwaukee Elec. Ry. & Lt., 7% pf.	*k*101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	*k* 98	....	....
Minn. Pwr. & Lt., 7% pf.	*l*104	104*	106*
Miss. Pwr. & Lt., pf.	106	....	....
Miss. River Pwr., 6% pf.	94	....	....
Miss. River Pwr., com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 no par.	104	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par	98	....	....
Mohawk Hudson Pwr., com.—no par	21½	20½	28½
Montana Pwr., pf.	*m*117	112½	119½
Montana Pwr., com.	82	69½	86½
Montreal Pwr., com.	*f* 70	....	....
Mountain States Pwr. pf.	96	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFLOK, LTG., pf.	97	....	....
National Carbon, pf.	*m*130	124	130
National Electric Pwr-A.	24	15½	26½
National Elec. Pwr., pf.	*m* 94	....	....
Nat. Lt., Ht. & Pwr., com.	*k* 24	22	25
National Lt., Ht. & Pwr., 5% pf.	*k* 70	71	73
National Pwr. & Lt., pf., $7—no par	101½	96	105
National Pwr. & Lt., com.—no par	21½	16½	38½
National Pub. Serv., 7% pf.	90	....	....
National Pub. Serv., pte. pf.	107	....	....
National Pub. Serv., A com.—no par	19½	15½	24
National Pub. Serv., B com —no par	14½	10	17½
Nebraska Pwr., 7% pf.	*l*107½	107½*	108½*
Nevada-Calif., Elec., com.	*k* 26	18½	44½
New Brunswick Pwr., pf.	*k* 58	30	60
New England Pub. Serv., pr. ln. pf.	*k* 99	98	101
New England Pub. Serv., pf.	*k* 93	95½	97
N. J. Pwr. & Lt., 7% pf.	94	94	94
New Orleans Pub. Serv., 7% pf.	102½	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	*k* 98½	98	100
Newport News & Hampton Ry., Gas & Elec., com.	*k*109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	*k*109	98	114
Niagara Falls Pwr., 7% pf.—25	*k* 28	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	113	109	111½
No. Amer., 6% pf.—50	51	49	52½
No. Amer., com.—10	42	42	67
No. Amer. Edison pf.—no par	*k* 96½	91½	97
No. Amer. Lt. & Pwr., pf.	*k*101	88	104
No. American Utilities, pf., full pd.	*m* 94½	89	96
No. American Utilities, pf., 25% pd.	*m* 19	18	27
N. C. Pub. Serv., pf.—$7—no par	93	....	....
Northeastern Pwr., com.	16½	15½	36½
No. Indiana Gas & Elec., pf. A	*k*102½	98	103½
No. N. Y. Utilities, 7% pf.	104	....	....
No. Ohio Pwr., com.—no par	10½	9½	26½
No. Ohio Trac. & Lt., 6% pf.	*k* 76	78	81
No. Ohio Trac. & Lt., 7% pf.	*k* 92	88	96
No. Ont. Lt. & Pwr., pf.	*k* 86½	75	88½
No. Ont. Lt. & Pwr., com.	*k* 74	73	78
No. States Pwr., 7% pf.	102	....	....
No. States Pwr. com.	110½	97	136½
No. Texas Elec., 6% pf.	58	....	....
No Texas Elec., com.	23	....	....
OHIO BRASS, com. B —no par	76	74	80
Ohio Brass, pf.	*k*100	98	101
Ohio Gas & Elec., 7% pf.	*k* 94	90	95
Ohio Pwr., 6% pf.	96	60	96½
Ohio Pub. Serv., 6% pf.	*l* 95½	93	94
Ohio Pub. Serv., 7% pf.	*l*104	96	104
Ohio River Edison, pf.	102½	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	99½	....	....
Pacific Gas & Elec. com.	129	118	133½
Pacific Pwr. & Lt., 7% pf.	*l*102½	102½*	102½*
Parr Shoals Pwr., 6% pf.	*k* 92	90	97½
Penn Central Lt. & Pwr., pf.—no par	*c* 72½	70½	91
Penn-Ohio Edison, 7% pf.	99	95½	97½
Penn-Ohio Elec., 7% pf.	*k* 95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	*k* 98	94	100
Penn-Ohio Pwr., & Lt., 8% pf.	*k*109	100	111
Penn Pwr. & Lt.—$7—no par	*l*106	105½*	106½*
Penn Pub. Serv., 7% pf.	*k*103	96	103
Penn Pub. Serv., 6% pf.	*k* 87	85	90
Penn Wtr. & Pwr., com.	*a*178	140	180
Phila. Co., 6% pf.—50	*c* 50	48	50½
Phila. Co., com.—50	*k* 85	59½	91
Phila. Elec., com.—25	*c* 51½	....	....
Pittsburgh Utilities, pf.—10	*m* 19½	14½	20½
Portland Elec. Pwr., 7% pf.	97	....	....
Portland Elec. Pwr., 6% pf.	81	....	....
Portland Elec. Pwr., 6% 2nd pf.	70	....	....
Portland Elec. Pwr., com.	29	....	....
Potomac Elec. Pwr., pf.	*m*107½	....	....
Pwr. Corp. of N.Y., com—no par	*m* 79	77½	90½
Pwr. Sec., pf.—no par	*k* 37	10	39
Pwr. Sec., com.—no par	*k* 6	4	13
Pub. Serv. of Colorado 7% pf.	*l* 99	....	....
Pub. Serv. of N. J., 7% pf.	*k*108½	....	....
Pub. Serv. of N. J., 8% pf.	*k*123½	115	124½
Pub. Serv. of N. J., com.—no par	32½	31½	33½
Pub. Serv. of No. Ill., 6% pf.	*a*101½	99½	106*
Public Serv. of No. Ill., 7% pf.	*a*113½	112	116½
Pub. Serv. of No. Ill., com.—no par.	*a*131	121	140
Pub. Serv. of No. Ill., com.	*a*131	128	143
Pub. Serv. of Okla., 7% pf.	*k* 99	92	100
Pub. Serv. Elec. & Gas, 6% pf.	102½	97	104½
Public Service Elec. Pwr., pf.	*k*113½	106	114
Puget Sound Pwr. & Lt., 7% pf.	103	....	....
Puget Sound Pwr. & Lt., 6% pf.	84	....	....
Puget Sound Pwr., & Lt., com.	31	....	....
RADIO CORP. OF AM., pf.—50	51½	44½	53½
Radio Corp. of Amer., com.—no par	52½	32	61½
Republic Ry. & Lt., pf.	115	....	....
Republic Ry. & Lt., com.	113	....	....
Rochester Gas & Elec., 5% pf.	*m* 95	....	....
Rochester Gas & Elec., 6% pf.	*k*102	98	102
Rochester Gas & Elec., 7% pf.	106	....	....
SAN JOAQUIN LT. & PWR., 7% pf.	*k*106	97½	108
Safety Cable, com.	52½	42½	55½
St. Joseph Ry., Lt., Ht. & Pwr., pf.	*k* 67	60	70
Servel Corp.,	8½	5½	22½
Sierra Pacific Elec., com.	24½	....	....
Sioux City Gas & Elec., 7% pf.	100	....	....
S. E. Pwr. & Lt., pf.—$7—no par	*k*101	97	103
Southeastern Pwr. & Lt., pfc. pf.	68	59	69½
S. E. Pwr. & Lt., com.—no par	31½	20	46½
So. Calif. Edison, 8% pf.—25	*k* 34	32½	36
So. Calif. Edison, 7% pf.—25	27	....	....
So. Calif. Edison, 6% pf.—25	24	....	....
So. Calif. Edison, com.	32	30	33
Southern Cities Utilities, 7% pf.	85	....	....
Southern Cities Utilities, com.	30	....	....
Southwestern Lt. & Pwr., A.	63	....	....
Southwestern Lt. & Pwr., B.	63	....	....
Southwestern Lt. & Pwr., $6 pf.	82	....	....
Southwestern Pwr. & Lt., 7% pf.	*k*103½	100	105
Springfield (Mo.) Ry. & Lt., 7% pf.	*k* 97	95	100
Standard Gas & Elec., 8% pf.	57½	53½	57½
Standard Gas & Elec., 7% pf.	102½	....	....
Standard Gas & Elec., com.—no par	55	51	69
Standard Pwr. & Lt., 7% pf.	97	....	....
Staten Island Edison, pf.—$6—no par	96	....	....
Superheater, com.—no par	164	....	....
Syracuse Lighting, 7% pf.	*k*102	105	107
Syracuse Lighting, 8% pf.	*k*115	....	....
Syracuse Lighting, com.	*k*300	260	355
TAMPA ELEC., com.	47½	....	....
Tenn. Elec. Pwr., 6% pf.	92	....	....
Tenn. Elec. Pwr., 7% pf.	102	....	....
Terre Haute, Ind. & East Trac., pf.	*k* 20	20	37
Terre Haute, Ind. & East. Trac., com	*k* 1	1	7
Tex. Pwr. & Lt., 7% pf.	*k*108½	107	109
Tide Water Pwr., 8% pf.	105	....	....
Timken Roller Bearing, com—no par	79½	44½	85½
Toledo Edison, 8% pf.	*l*114	111	114
Toledo Edison, 7% pf.	*l*104	101	103
Toledo Edison, 6% pf.	*l* 94½	90	95
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	*k* 90	87½	90
UNITED GAS & ELEC., 6% pf.	97½	....	....
United Gas & Elec., com.—no par	*m* 57	56	66
United Gas & Elec. (N.J.), 5% pf.	71	....	....
United Gas Impr.—50	*c* 90½	....	....
United Lt. & Pwr. pf.—$4—no par	*k* 49½	44	53
United L. & P. pf.—$6.50—no par	*k* 86½	81	91
United Lt. & Pwr., com., A—no par	14½	10½	28
United Lt. & Pwr., com., B—no par	*k* 16	13	29
Utah Pwr. & Lt., 7% pf.	*l* 103½	103½	104½
Utica Gas & Elec., 7% pf.	104½	....	....
Utica Gas & Elec., com.	*k*200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A	27½	27½	37
Utilities Pwr. & Lt., com. B—no par	13½	13½	18½
VERMONT HYDRO - ELEC., 7% pf.	94	93	96½
Virginia Elec. & Pwr., 7% pf.	*k*105	101	105
Virginia Pwr., 7% pf.	*k*108	102	104
Virginian Pwr., com.	*k* 70	65	75
WAGNER ELEC., pf.	*m* 72	61½	85
Wagner Elec., com.—no par	*b* 19	13½	34½
Washington Ry. & Elec., com.	175	....	....
Washington Ry. & Elec., pf.	89	....	....
Washington Wtr. Pwr., com.	*k*136	130	138
West Mo. Pwr., 7% pf.	*m* 92	....	....
West Penn Elec., pf.	102½	95½	102½
West Penn Elec., Class A.	97½	88½	98½
West Penn Pwr., 6% pf.	*k*111½	108	115
West Va. Lt., Ht. & Pwr., 7% pf.	*k* 94½	95	98
West Va. Utilities 7% pf.—50	49½	42	50
Western Pwr., 7% pf.	98	91½	99
Western States Gas & Elec., 7% pf.	93	....	....
Western States Gas & Elec., com.	17	....	....
Westinghouse El. & Mfg., com—50	68½	65	79½
Weston Elec. Instrument, Class A.	*k* 30½	27½	32½
Weston Elec. Instrument, com.	15½	13½	19½
Wheeling Elec., pf.	*k* 95	91	97
Wis. Pwr., Lt. & Ht., 7% pf.	*k* 95	85	91
Worthington Pump, pf. A	48	44	80
Worthington Pump, pf. B	*k* 42	37½	65
Worthington Pump, com.	22	19	44½
YADKIN RIVER PWR., 7% pf.	*l*107½	107½*	107½*
Yale & Towne, com.—25	*k* 70½	60½	72½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *k*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high, Friday, Dec. 31. *l*Bid, low, high, Wednesday, Jan. 5. *m*Latest quotations available. *1927

Pittsburgh Transformer Company Declares Extra Dividend.—In addition to the regular dividends on the common and preferred stocks, the directors of the Pittsburgh Transformer Company declared a Christmas dividend of 2 per cent on the common stock which was payable Dec. 31.

New Japanese Company Organized.—Japanese, American and English interests have combined in a co-operative undertaking to form under Japanese laws a new company to be known as the Japanese Electric Bond & Share Company. The initial capital of the company will be 10,000,000 yen. According to present plans, the company will operate in Japan along the lines of the Electric Bond & Share Company in the United States with such modifications as local conditions may make necessary. Japanese interests officially represented in the company are the Tokyo Marine & Fire Insurance Company, which is closely allied with the Mitsubishi interests; the Yasuda Holding Company, Inc., the Mitsui interests, the Tokyo Electric Light Company, Ltd., and the Toho Electric Power Company, Ltd. The American and English interests are the Guaranty Company of New York, the International General Electric Company, the Electric Bond & Share Company, Lazard Brothers & Company, Ltd., London; Lazard Frères, New York; Sale & Company, London, and Sale & Company, Tokyo.

Illinois Power & Light to Redeem Debentures.—On or before April 1, 1927, the Illinois Power & Light Corporation will retire its 7 per cent 30-year sinking-fund debenture gold bonds, which are now outstanding to the amount of $9,614,800. The new debentures, which will probably be dated March 1, 1927, will bear a substantially lower rate of interest, probably 5½ per cent. This will result in a considerable saving to the company and to the individual holders of its stock.

Canadian Companies Elect New Directors.—J. S. H. Wurtele and P. T. Davies have been elected to the board of directors of the Southern Canada Power Company. The new directors have been connected with the company for some years, Mr. Wurtele in the capacity of plant manager and Mr. Davies as commercial manager. At a meeting of the board of directors of the Montreal Water & Power Company all but one of the old directors resigned their respective positions, F. H. Pitcher, the general manager, retaining his seat. Edwin Hanson, F. W. Evans, A. F. Riddell, William Hanson, Tancrede Bienvenu and E. Gerald Tanson were succeeded by W. Q. Stobo of Quebec, G. B. Allison, W. H. Sutherland and R. G. Liddy of Montreal and C. M. Barnett and W. W. Wetherspoon of New York.

Montana Power Sales up 10 Per Cent

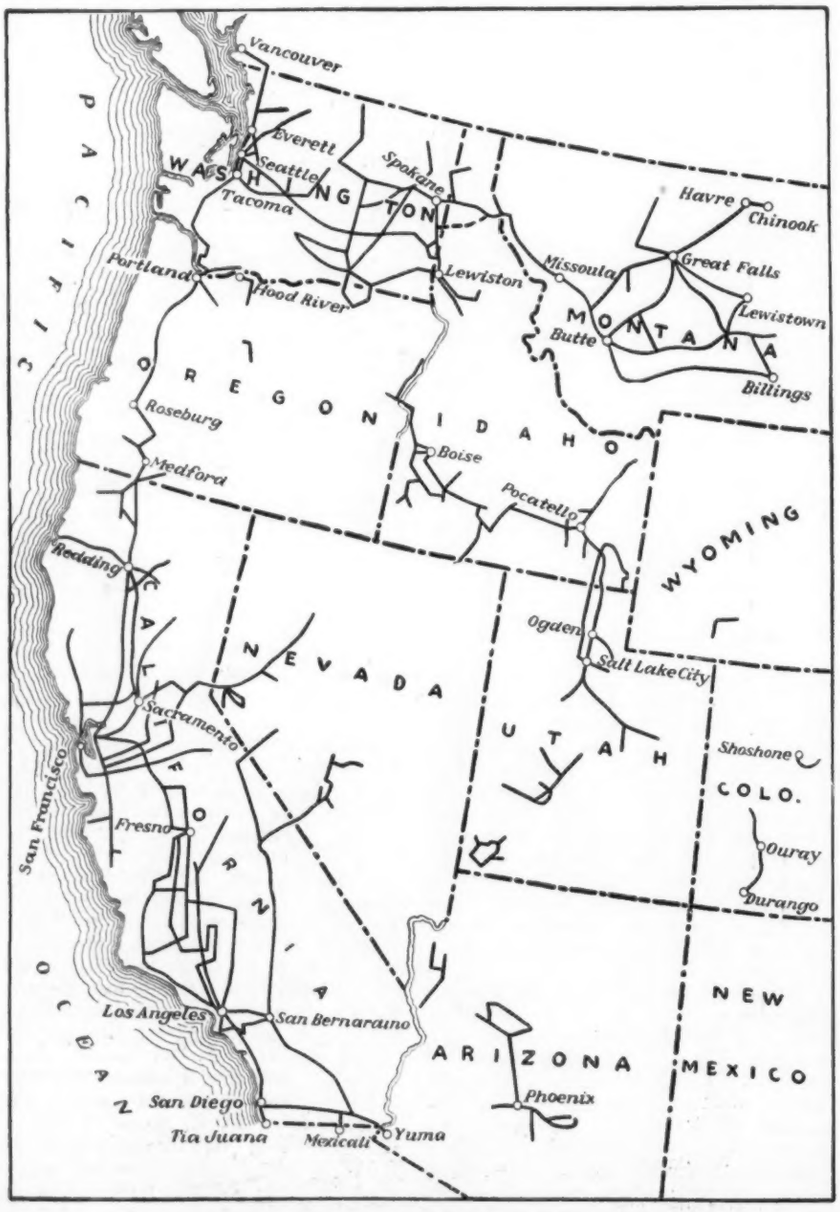
Western Company Presents One of the Best Examples to Be Found in the Country of the Benefits Derived from Interconnection Between Systems

THERE is probably no more outstanding example in the United States of the advantages of interconnection than that afforded by the Pacific Coast group of companies in which Montana Power is a link. The chain of interconnection is now complete between Billings, Mont., and San Diego, Cal. Relations between the Montana company and such companies as Washington Water Power have been particularly advantageous. Shortages in one section have been made up in another. The group illustrates how mutual co-operation combined with advances in the art of transmitting electrical energy is bringing nearer the day when reserves of power in one part of the country will be available over an enormously wider area than that of the producer's own territory.

Montana Power is in many respects an exemplary operating unit. In the capital set-up obligations amount to only 36 per cent of capitalization. New investments in recent years required the issue of bonds totaling more than $4,000,000, but in the same period retirements totaling $2,857,200 were made. The unbonded balance of fixed property has increased by almost $2,000,000, while the increase in preferred and common stock has been extremely small.

From an earnings standpoint, the growth of Montana Power has been less rapid than that of the industry as a whole. This is due, partly at least, to the nature of the territory served. On the other hand, the operating ratio of 30 per cent is unusually low, and a 10 per cent increase last year in the volume of power sold indicates the progress that is being made. The increase in gross earnings is well distributed among the different classes of service, indicating a balanced growth. The largest single increase was in sales for smelting. The company's service was distributed as follows:

	Per Cent
Light and heat	24.0
Smelting and reduction	28.4
Coal mining	1.6
Metal mining	21.0
Electrified railroads	12.8
Street railways	1.0
Miscellaneous	11.2
Totals	100.0



INTERCONNECTED ELECTRIC SYSTEMS ON PACIFIC COAST

SET-UP, EARNINGS AND FINANCIAL POSITION OF MONTANA POWER COMPANY

1. **Financial Set-Up**—(December, 1925):
   - Ratio debt to capitalization, 36 per cent.
   - Ratio gross revenue to capitalization, 1 to 11.
   - Ratio funded debt to gross, 4 to 1.
   - Ratio investment to capitalization, 103 per cent.
   - Ratio investment to gross, 11⅓ to 1.
   - Debt per dollar of net, $5.90.
2. **Revenue Record:**
   - Operating ratio, 30 per cent.
   - Ratio revenue to total assets, 1 to 12.
   - Ratio net earnings to revenue, 1 to 1.5.
   - Times bond interest earned — Almost three times.
   - Preferred dividend earned, $34.37.
   - Common dividend earned, $5.40.
   - Earnings compared with whole industry—Growth less rapid.
3. **Trust Investment Tests:**
   - Life of franchise after bond maturity—Ample margin.
   - Percentage debt to book value of property, 36.
   - Size of gross, $8,572,241.
   - Size of net, $5,466,642.
   - Type of mortgage—Modern, open-end.
4. **Business Progress:**
   - Kilowatt-hours sold, 1,234,052,127.
   - Increase during year, 10 per cent.
   - Annual load factor, 81.6 per cent.
   - Revenue increase over 1924, 6.7 per cent.

Company Reports

The following statements of earnings have been issued by electric light and power companies:

Name of Company	Gross Earnings Twelve Months Ended Nov. 30, 1926	1925
Bangor Hydro-Electric	$1,707,968	$1,578,277
Baton Rouge Electric	946,336	788,879
Binghamton Lt., Ht. & Pwr.	1,910,906	1,660,510
Blackstone Valley Gas & El.	5,427,392	5,011,431
Cape Breton Electric	607,435	565,055
Carolina Power & Light	8,086,081	6,861,341
Central Illinois Light	4,168,016	3,900,110
Commonwealth Power	48,887,334	43,582,112
Consumers Power	23,862,848	20,328,701
Continental Gas & Electric	26,268,759	23,228,827
Edison Elec. Illg., Brockton	1,762,922	1,661,904
Electric Power & Light	49,425,346	45,182,377
Electric Light & Power of Abing. & Rockland	580,829	526,023
El Paso Electric	2,804,801	2,533,943
Florida Public Service	1,633,572	1,012,434
Galveston-Houston Elec.	4,505,672	3,928,754
General Gas & Electric	23,779,377	20,801,818
Illinois Power	2,572,177	2,479,729
Kansas City Pwr. & Lt.	10,707,185	10,220,250
Lowell Electric Light	1,713,816	1,610,436
Metropolitan Edison	9,503,666	8,605,401
New Jersey Pwr. & Lt.	2,367,225	1,304,272
North Carolina Pub. Service	2,059,209	1,849,648
Northern Ohio Power	12,000,144	11,412,652
North Texas Electric	2,524,395	2,484,133
Ohio Edison	1,802,911	1,545,737
Pacific Power & Light*	3,744,882	3,430,413
Penn-Ohio System	12,579,509	11,215,577
Portland Elec. Power	11,701 528	10,991,487
Puget Sound Power & Light	13,42[illegible],532	12,825,107
Savannah Elec. & Pwr.	2,2[illegible],304	[illegible],942,035
Sierra Pacific Elec.	1,249,271	1,141,723
Southern Calif. Edison†	25,031,759	22,361,835
So. Indiana Gas & Elec.	2,862,947	2,662,846
Tampa Electric	4,816,505	3,211,383
Tennessee Electric	11,963,872	11,298,366
United Light & Power	40,992,894	35,980,973
Winnipeg Electric†	5,080,703	4,838,174

*Twelve months ended Oct. 31.
†Eleven months ended Nov. 30.

Manufacturing and Markets

Construction Data Applied to Market Development

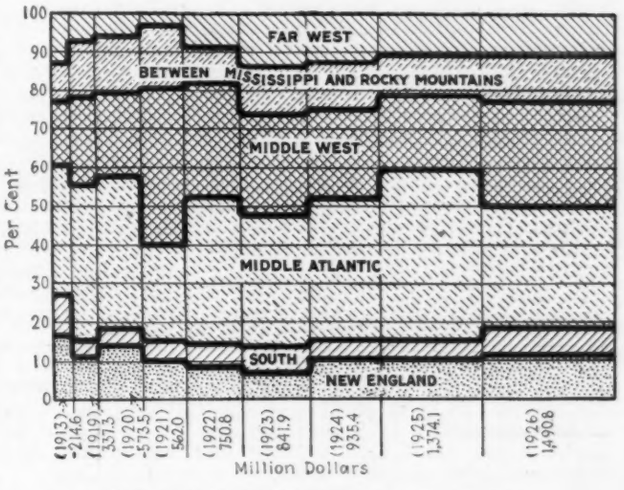
Useful in Building Sales Organizations, Planning Sales Quotas and Checking Sales Volume

BUSINESS trends in the United States as indicated by new construction can be seen in the three accompanying charts, covering industrial building, commercial and institutional building and all heavy construction. These charts show with respect to new construction the proportion that each section of the country bears to the whole country in 1913 and for the years 1919 to 1926. They thus show the ebb and flow of business in the principal regions. The distance between each pair of heavy horizontal lines is the percentage of that territory to the total and may be read on the scale at the left. The width of each year is determined by the total value of the work done in that year, and this value is given in millions of dollars at the base of the chart. Though at first glance the charts may look alike, they really tell three stories. The chart covering industrial building indicates production growth; that covering commercial and institutional building indicates distribution growth, and that covering all heavy construction indicates the trend of general business conditions.

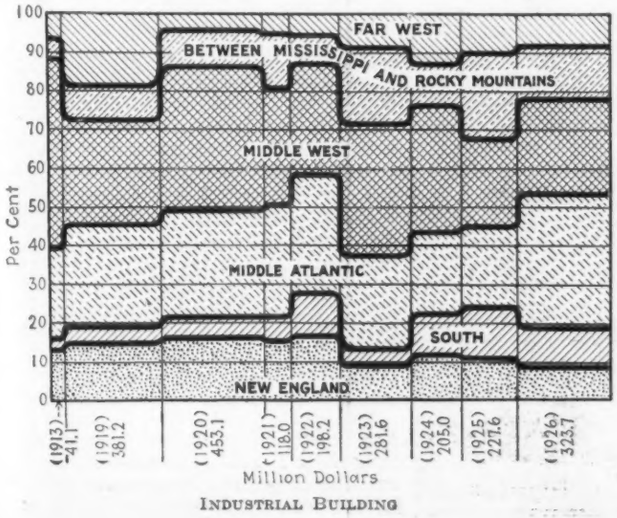
COMPARISON OF CONSTRUCTION VOLUME IN UNITED STATES

INDUSTRIAL BUILDING

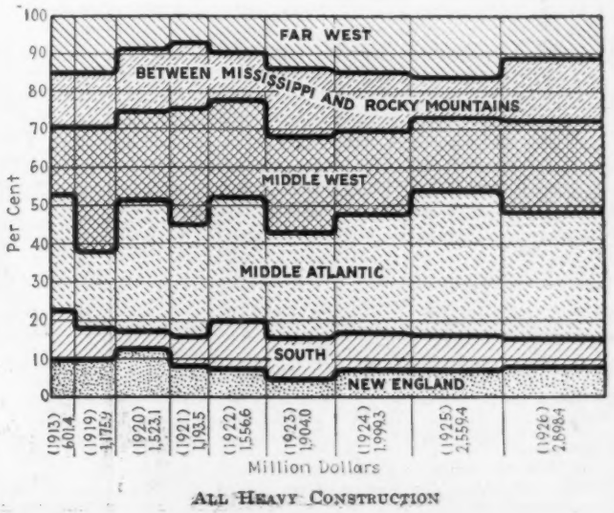
In the chart for industrial building the original figures are the value of construction contracts awarded for new industrial buildings of $40,000 and more. As company officials authorize plant extensions only when they can see the need for greater production, the figures from which this chart was made give a sound index of the changing importance of the sections as industrial or production regions. For instance, there is depicted the gradual lessening of industrial building in New England and a gradual increase in the South. In the chart for commercial and institutional building the figures used are the value of construction contracts awarded for new commercial buildings of $150,000 and more. These buildings are banks, offices, stores, and in fact all types except industrial and small residential. These figures reflect the commercial side of business—the development of new markets to take care of increasing production. The chart for



COMMERCIAL AND INSTITUTIONAL BUILDING



INDUSTRIAL BUILDING



ALL HEAVY CONSTRUCTION

Value of Engineering Contracts by States and Per Cent Each State Bears to Total Construction

	1925 (12 months) Value	Per Cent of Total Construction	1926 (10 months) Value	Per Cent of Total Construction
Maine	$6,264,000	0.25	$9,809,000	0.41
New Hampshire	5,195,000	0.21	4,927,000	0.24
Vermont	2,329,000	0.09	5,497,000	0.23
Massachusetts	132,145,000	5.20	117,718,000	4.85
Rhode Island	18,314,000	0.71	16,666,000	0.69
Connecticut	35,123,000	1.38	48,701,000	2.01
New England	$199,370,000	7.84	$203,318,000	8.43
New York	$559,946,000	21.28	$371,814,000	16.23
New Jersey	54,817,000	2.14	71,181,000	2.95
Pennsylvania	275,620,000	10.80	205,048,000	8.50
Maryland*	42,504,000	1.70	87,710,000	3.53
Delaware	2,329,000	0.08	2,215,000	0.09
Middle Atlantic	$935,216,000	36.00	$737,968,000	31.30
Virginia	$8,833,000	0.30	$7,469,000	0.31
West Virginia	18,048,000	0.70	9,912,000	0.41
North Carolina	41,817,000	1.60	35,361,000	0.14
SouthCarolina	5,787,000	0.20	2,952,000	0.12
Georgia	11,934,000	0.50	11,799,000	0.48
Florida	59,742,000	2.30	66,230,000	2.74
Alabama	23,600,000	0.90	23,761,000	0.98
Mississippi	15,795,000	0.70	16,696,000	0.69
Louisiana	25,807,000	1.10	28,020,000	1.11
Kentucky	14,377,000	0.50	17,585,000	0.73
Tennessee	22,226,000	0.90	22,875,000	0.95
Southern	$247,966,000	9.70	$242,660,000	8.66
Ohio	$154,140,000	6.70	$128,700,000	5.33
Indiana	21,431,000	0.70	42,894,000	1.76
Illinois	177,532,000	7.00	282,957,000	11.71
Wisconsin	51,783,000	2.00	56,202,000	2.32
Michigan	69,326,000	2.70	99,306,000	4.52
Middle West	$474,212,000	19.10	$610,059,000	25.64
Minnesota	$34,760,000	1.36	$28,946,000	1.20
Iowa	22,739,000	0.89	31,002,000	1.28
Missouri	138,463,000	5.45	89,798,000	4.04
Arkansas	12,213,000	0.48	15,481,000	0.64
North Dakota	2,920,000	0.11	3,637,000	0.15
South Dakota	4,183,000	0.16	4,462,000	0.19
Nebraska	29,519,000	1.15	15,270,000	0.63
Kansas	23,323,000	0.92	17,865,000	0.74
Oklahoma	35,177,000	1.37	23,563,000	1.00
Texas	91,939,000	3.54	116,032,000	4.71
Montana	1,177,000	0.05	2,694,000	0.11
Wyoming	1,570,000	0.06	925,000	0.04
Colorado	8,616,000	0.34	6,916,000	0.29
New Mexico	959,000	0.04	649,000	0.03
West of Mississippi	$407,558,000	15.92	$357,240,000	15.05
Idaho	$6,056,000	0.23	$4,5,9,00	0.19
Utah	405,000	0.01	139,00	0.01
Arizona	2,207,000	0.10	2,272,000	0.09
Nevada	1,518,000	0.10	2,209,000	0.09
Washington	40,175,000	1.50	24,614,000	1.02
Oregon	14,996,000	0.50	6,556,000	0.27
California	229,764,000	9.00	223,748,000	9.25
Far West	$295,121,000	11.44	$264,117,000	10.92
United States	$2,559,443,000	100.00	$2,415,352,000	100.00

*Including District of Columbia.

heavy construction includes not only the figures for industrial and commercial construction but the data on all other construction except residential. In addition to buildings there are streets and roads, water-works, sewers, bridges, tunnels, dams, railway work and many other kinds of enterprises. These figures thus reflect the general state of mind of business. It may be said that when business is prosperous construction is active and when construction is active business is prosperous.

A new building calls for boilers, pumps, electric wiring and fixtures, blowers, metal products, piping and in fact products touching virtually every industry. New business is to be found where construction is concentrated. The table showing the value of engineering contracts by states gives the percentage of total value by states for 1925 and 1926 (ten months). For example, the figure for Maine means that 0.41 per cent of all the important construction contracts let in the United States in 1926 were let in the State of Maine. Many manufacturers are using these figures in their sales organizations for planning sales quotas and checking sales volume. The map compares the construction volume in the United States and shows where the volume in 1926 was greater, less than or about the same as it was in 1925. The map thus shows at a glance the trend of general business conditions. Thus in the states of Michigan, Iowa, Illinois, Connecticut, New Jersey, Maryland and Texas construction was definitely larger in 1926 than in 1925. Only five states showed a decline in construction volume.

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

Division	November 1925	November 1926	Per Cent Increase or Decrease	Eleven Months 1925	Eleven Months 1926	Per Cent Increase or Decrease
New York	245	244	— 0.40	3,870	3,837	— 0.85
Middle and Southern Atlantic	158	150	— 5.06	2,515	2,051	—18.4
New England	56	150	+167.8	905	1,353	+49.5
Pacific Coast	8	10	+ 25.0	193	240	+24.3
Central	675	687	+ 1.78	9,574	9,322	— 2.63
Total	1,142	1,241	+ 8.67	17,057	16,803	+ 1.49

TOTAL AMOUNTS REPORTED

Division	November 1925	November 1926	Per Cent Increase or Decrease	Eleven Months 1925	Eleven Months 1926	Per Cent Increase or Decrease
New York	$31,712	$42,131	+32.8	$546,06	$569,750	+ 4.34
Middle and Southern Atlantic States	14,457	22,940	+58.6	324,87	244,520	—24.7
New England	6,219	9,909	+59.3	97,781	94,571	— 3.2
Pacific Coast	509	432	—15.0	26,768	35,407	+32.2
Central	115,835	69,573	—39.9	1,190,394	1,029,831	—13.5
Total	$168,732	$144,985	—14.0	$2,185,875	$1,974,079	— 9.7

AVERAGE AMOUNTS

Division	November 1925	November 1926	Eleven Months 1925	Eleven Months 1926
New York	$129	$172	$141	$148
Middle and Southern Atlantic States	91	153	129	119
New England	111	66	108	69
Pacific Coast	63	43	138	147
Central	172	101	124	110

Sales Statistics on Direct-Current Motors

Orders entered for direct-current motors during the month of October showed a decrease of nearly 15 per cent as compared with orders last month, the second largest month in the year. It is expected that beginning Jan. 1, 1927, the number of units and the aggregate horsepower will also be included in these sales statistics.

ORDERS ENTERED AND SALES BILLED FOR DIRECT-CURRENT MOTORS

(1-hp to 200-hp. inclusive, built in general-purpose motor frames, including control equipment sold with motors and excluding spare parts.)
(Issued by National Electrical Manufacturers' Association—Apparatus Division)

Month, 1926	Orders Entered	Billings
January	$815,976.75	$934,124.01
February	878,028.36	807,281.31
March	1,167,748.91	1,027,318.84
April	866,858.52	821,946.62
May	740,231.54	793,832.28
June	904,269.40	928,272.
July	740,424.22	876,257.25
August	792,613.03	876,296.67
September	937,913.01	745,782.97
October	801,035.97	837,214.13
Year to date	$8,645,099.7	$8,648,326.49

Business Conditions

MANUFACTURERS report considerable activity on the part of central-station companies. The number of inquiries received presages an active first-quarter business. Many of the sales will include substation equipment for interconnection work as well as power transformers and switching apparatus. Central-station companies evidently are already bringing to a culmination plans covering the expenditure of nearly a billion dollars this year for new construction and maintenance. An order for a 165,000-kw. turbo-generator is expected to be placed in a few days, and several orders for smaller units were placed.

In New England buying of power equipment is active and included a 35,000-kw. unit for a southern New England plant and a 10,000-kw., 1,200-lb. pressure turbo-generator unit for a central-station company. An unusual volume of small-motor sales was also recorded. Many inquiries for apparatus are received by manufacturers in the New York district. These cover a large amount of substation equipment, but are of a mixed character otherwise. Industrial plants continue to be good buyers. In the Southeast good purchases were made by central-station companies and included $15,000 worth of voltage regulators, $6,500 worth of subway transformers and several small orders for substation equipment. An order was also placed for a 5,000-kw. turbo-generator and a substation for a textile mill. Sales are active in the St. Louis district, but no large orders were reported. Continued activity is anticipated in the petroleum fields tributary to St. Louis. A heavy utility construction program is planned in the Middle West, and building plans for the year are quite comprehensive. On the Pacific Coast an improvement in sales is noted, with industrial firms buying actively. The closing of logging camps and lumber mills in the Puget Sound district resulted in a repair and replacement business made up of small and scattered orders but in good volume.

Metal Prices Show Decline in an Inactive Market

Each of the major metals is commanding a lower price than it did one year ago, and the metal market has been dull, with the single exception of tin sales. The copper market continued a downward course. Last week Thursday a large volume of business was done at 13¼ cents, with lesser quantities bringing 13⅜ cents. Any reasonable quantity seems to be available now at 13¼ cents. Lead has not been firm, though there has been no great pressure on the market. Zinc is easier in the domestic market and tin prices have advanced.

NEW YORK METAL MARKET PRICES

	Dec. 29, 1926 Cents per Pound	Jan. 5, 1927 Cents per Pound
Copper electrolytic	13⅜	13⅛
Lead, Am. S. & R. price	7.80	7.80
Antimony	13	12⅜
Nickel, ingot	35	35
Zinc spots	7.35	7.25
Tin, Straits	66.875	66⅜
Aluminum, 99 per cent	27	27

Base copper price Jan. 5, 1927, 15⅜ cents.

Many Inquiries Reported in the New York District

Inquiries of a mixed character, including some for a large amount of substation equipment, are being received by manufacturers in the New York district. Much of this material will be bought by holding companies and is primarily for interconnection work. Many sales of this material and good power-transformer and switching-equipment business are anticipated by manufacturers during the first quarter of the year. An order for a 165,000-kw. turbo-generator unit will probably be placed in a few days. Sales of motors to industrial plants are good, and control apparatus is in demand, particularly in the machine tool and printing industries.

Equipment Buying Active in New England District

Resumption of buying of electrical equipment and supplies was sufficiently active in the New England district to introduce the new year with a striking sales volume. Most marked in the week's record of trade was the unusual volume of small motor sales, orders for several large lots ranging from $2,000 to $15,000, and the total reported reached well over $100,000 for the district. Two interesting contracts for turbo-generator units were closed. One for a 35,000-kw. unit for a southern New England plant is part of a four-million-dollar extension which will be carried out in the near future, and the other contract covered a 10,000-kw. high-pressure turbo-generator unit.

Several negotiations for switches and control apparatus are under way at this time. As compared with last year, a prominent manufacturer states that as much electrical trade is in view, and with the growth of electrical power in the district and the increasing general utility, there appears to be little diminishing of sales. Electric range sales are reported active, and the general jobbing tone has been steady.

Heavy Utility Construction Program in Middle West

Business in all sections of the Middle West started the year with the utmost confidence and a large amount of optimism. It is admitted that the year 1926 was a prosperous one, and it is expected that sales this year will equal if not surpass those of 1926. Industrial activity is entirely satisfactory, and building plans for the year are quite comprehensive. The various utility companies are busy and 1927 looks like a large year for that field. Among the interesting orders placed was one for substation-type storage batteries valued at nearly half a million dollars. A number of smaller orders for apparatus were also placed. There has been a very fair demand for distribution equipment. Jobbers' sales are generally good.

Business Continues in Good Volume in the Southeast

Orders for voltage regulators approximating $15,000 and for subway transformers amounting to $6,500, as well as several small orders for substation equipment and various types of transformers, were placed in the Southeast. A manufacturer reports the receipt of an order for a 5,000-kw. turbo-generator for installation in the western part of the territory, while estimates are being prepared on two other turbines of larger capacity, and prospects are that these two orders will be placed in the very near future. A fleet of sixteen electric trucks recently ordered by a Florida firm went into operation last week. The year just closed has been a reasonably successful one in the sale of electric trucks. Contracts were let last week for a substation and transformer equipment for a new textile mill in north Georgia, and orders covering motors and wiring will probably be placed in a few days. The electrical equipment for this mill will total approximately $30,000.

One of the larger Southeastern power companies has announced a seventeen-million-dollar budget for 1927, and the great bulk of this amount will go into the construction of a large hydro-electric plant. Some good sign business is in prospect, and a large concern is planning to spend about $20,000 in the near future for electric signs for its retail branch stores. Jobbers report that sales during the holiday season probably set a new high record for the territory.

Sales Active, but no Large Orders Placed in St. Louis District

No important sales or contracts were reported in the St. Louis district, but manufacturers say that a good volume of business was transacted. Jobbers report that the sales of miscellaneous merchandise were in good volume throughout the holiday season, but there is a prospect of a decrease in business for the next week or two. The predictions for 1927 in the electrical industry are all favorable. The wonderful activity for the past year in the petroleum fields tributary to St. Louis will probably be duplicated, if not increased. Recent orders received from the oil fields include one for 50 motors for pumping wells in the Texas-Panhandle field and another for the complete electrical equipment for a pipe-line pumping station in the central Illinois district.

Improvement Noted in Sales on Pacific Coast

Most encouraging reports of 1927 business on the Pacific Coast are being received, the improvement being already markedly perceptible. This is especially true of industrial and dealers' business. For instance, an oil com-

pany has purchased 300 large vapor-proof reflectors, various oil-burner manufacturers have bought about 300 motors, a cement company purchased four motors of 650 hp. each, totaling about $30,000, and a lumber company ordered about $2,500 worth of 3,500-volt lead-covered cable. Several interesting inquiries have also been received for wiring supplies. Jobbers report good stock orders from dealers for staples and counter-display material, also several orders from interior contractors for comparatively unusual material, such as No. 8 and No. 10 wire and heavy wiring goods, indicating much small factory work.

The closing of logging camps and lumber mills in the Puget Sound district for from ten days to a month resulted in a repair and replacement business made up of small and scattered orders but in good volume. A few of the larger orders were one of several motors from 50 hp. down for a mill at Port Ludlow, another for about ten motors from 20 hp. down for a mill in Tacoma, and another for about $3,000 worth of motors for a pulp mill at Edmonds, Wash. A large mill in Everett, Wash., contemplates purchasing a 3,000-kw. turbine, and another mill is getting quotations on several motors for a mill extension. The city of Seattle purchased two 10,000-kva. transformers and oil-circuit-breaker equipment for its North substation for $81,202. Seattle jobbers are optimistic.

Activities of the Trade

Railway & Industrial Gets Order for 27 220,000-Volt Switches

An order for 27 220,000-volt switches has been placed by the Southern California Edison Company with the Railway & Industrial Engineering Company, Greensburg, Pa. These switches are to be used on the Laguna Bell, Long Beach and Big Creek 2-A substations and are gang-operated "disconnects" and grounding switches.

General Electric Orders Estimated to Show 6 per Cent Increase

Orders received by the General Electric Company during 1926 are estimated to be about $318,000,000, which compares with $302,513,380 in the previous year. Sales of the company will probably show some recession during the last quarter of 1926, but this has been offset by the increase of about 10 per cent which was shown during the first nine months of the year as compared with the same period in 1925. Orders booked during the first nine months of 1926 were $246,993,637, while for the same period in 1925 sales amounted to $223,876,711.

American Brown Boveri Company Elects New Directors

Stockholders of the American Brown Boveri Electric Corporation at their annual meeting held on Jan. 5 at the executive offices at 165 Broadway, New York, unanimously approved the election of directors by the voting trustees. The following new members have been elected to the board of directors: Clifford Duckman of Pynchon & Company, New York; James I. Bush, vice-president of the Equitable Trust Company, New York; Allen Curtis of Curtis & Sanger, Boston; William M. Flook, representing the Anthony N. Brady estate, New York; Edward N. Goodwin, representing Brown Boveri & Company, Basle, Switzerland; Henry Lockhart, Jr., vice-president Blair & Company, Inc., New York; Theodore G. Smith, vice-president Central Union Trust Company, New York; Elisha Walker, chairman of the board and president of Blair & Company, and Frank R. Warton, formerly vice-president of the Allied Packers' Company. The older members, who with those just elected constitute the board of fourteen, are: Laurence R. Wilder, president of the company; William V. Griffin, representing the Anthony N. Brady estate; James Imbrie, president of Imbrie & Company, New York; William F. Ingold of Pynchon & Company, and John J. Rudolf of A. Iselin & Company, New York.

The new officers are as follows: William Flook, chairman of the executive committee; Frank R. Warton and Theodor Boveri, vice-presidents; Norman R. Parker, comptroller, and J. T. Wickersham, who has been acting secretary and treasurer, has now been appointed secretary and treasurer. New and important financial interests have thus become identified with the American Brown Boveri Company through the election to the directorate of representatives of Blair & Company, Inc., the Central Union Trust Company, the Equitable Trust Company and Curtis & Sanger.

Westinghouse Gets Another Large Order from Duquesne Light

A second contract for a 48,500-kva. turbo-generator unit to be installed at the Colfax station of the Duquesne Light Company in Cheswick, Pa., by the Byllesby Engineering & Management Corporation has been received by the Westinghouse Electric & Manufacturing Company. An order for a similar unit was also placed with the Westinghouse company several months ago by the Duquesne company.

Graybar Electric Sales Increase About 16 Per Cent

Sales of the Graybar Electric Company, New York, for the year 1926 are estimated at $77,000,000 as compared with $66,000,000 in 1925, according to Albert Lincoln Salt, president. This is an increase of about 16 per cent over the sales of 1925, which up to that time was the company's most satisfactory year. During 1926 the company added more distributing branches to its system, reaching from coast to coast, enlarged its organization and increased its selling facilities. One of the interesting developments in connection with the company's change in name is the rapidity with which the trade accepted the name of Graybar. When the change in name was decided on the company anticipated that there would be a good many dealers who had spent years in building up a prestige for the name "Western Electric" and who might want to change to some other nationally advertised product rather than sell the new name of Graybar. The Graybar company to mitigate this attitude prepared a stock of appliances with the Western Electric trademark, but before this stock was used up the name was so extensively advertised that dealers were refusing appliances with the Western Electric trademark and were insisting on products with the Graybar trademark.

President Salt, commenting on the business situation, said: "Our business has never been as good—our prospects never any better. Nineteen-twenty-seven, after all, is just another name for the continuation of 1926. We see nothing on the business horizon that would lead us to look for any marked change in our business. This electrical business of which we are a part is so new, so broad, its ramifications touch so many industries and so many people, that it is always susceptible of expansion. The next twelve months look very encouraging to us, and we feel that Graybar will continue to grow as it has grown—and all our plans are based accordingly."

Babcock & Wilcox and G. E. Get Orders for High-Pressure Units

The Boston Edison Company has recently placed an order with the General Electric Company for a 10,000-kw. steam turbo-generator to operate at 1,200 lb. per square inch. This unit will be installed in the Edgar plant. The company has also placed an order with the Babcock & Wilcox Company, 85 Liberty Street, New York, for two new B. & W. boilers designed for 1,400 lb. per square inch steam pressure and rated at 1,500 hp. each.

Westinghouse Electric Retires Machine Company Bonds

The Westinghouse Electric & Manufacturing Company has called for redemption on Feb. 1, 1927, $6,000,000 of the Westinghouse Machine Company 6 per cent bonds, which were assumed by the Electric company in 1917 when the Machine company was merged with the Electric company. The payment of these bonds removes all liens of any kind on the Westinghouse Electric properties, and it is understood that payment has been made out of surplus cash and that no new financing is contemplated. On Nov. 1, 1927, the Westinghouse Electric company redeemed its issue of 7 per cent gold notes, replacing them with an issue of equal amount of 5 per cent notes, and this, with the redemption of the Machine company bonds, makes a substantial reduction in fixed charges as well as increasing the equity for the stock.

General Electric Announces New Refrigeration Department

A separate department, to be known as the electric refrigeration department, has been set up by the General Electric Company, effective since Jan. 1, 1927. T. K. Quinn, formerly assistant general sales manager of the national division of the incandescent lamp department, has been made manager of the electric refrigeration department, reporting to the president. P. B. Zimmerman, formerly manager of the publicity department of the national division of the incandescent lamp department, has been appointed sales manager of the electric refrigeration department.

The Elliott-Fisher Company, 342 Madison Avenue, New York, has acquired the assets and business of the Sundstrand Corporation, manufacturer for over ten years of ten-key Sundstrand adding, bookkeeping and calculating machines, with factories and general offices at Rockford, Ill. The products of the two constituent organizations will be marketed by the General Office Equipment Corporation, a subsidiary of the Elliott-Fisher Company.

James L. Mayer and Frederick E. Oswald announce the opening of a sales office for industrial engineering equipment at 332 So. La Salle Street, Chicago. They are now representing the Dings Magnetic Separator Company and the Saginaw Stamping & Tool Company.

The Pittsburgh Transformer Company, Pittsburgh, has opened a district office at 1214 Allen Building, Dallas, Tex. This office will handle sales and service work in the states of Texas and New Mexico under the supervision of N. H. Spencer, manager. Prior to the opening of this new office the Pittsburgh Transformer Company was represented in this territory by W. M. Beaman & Company.

New Equipment Available

Floor Grating

A type of steel flooring designed especially to meet the requirements common to central-station companies and power plants has been developed by the Walter Bates Steel Corporation, Gary, Ind. This steel floor grating is said to be strong, durable, slip-proof, safe and fireproof, and it is relatively of light weight and low cost. It affords air circulation and light penetration and has no angles or openings where dirt can gather. It is sanitary and attractive and has a positive lock joint which is said permanently to prevent loosening and chatter.

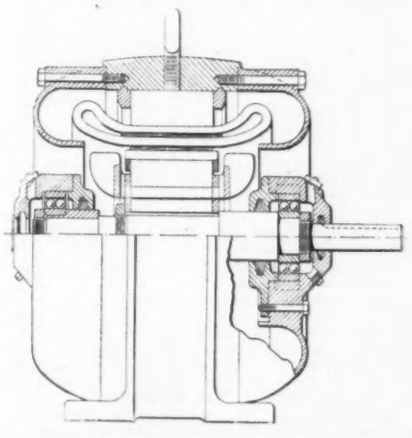
Airport Projector

A new type of airport projector for the lighting of airplane landing fields has recently been made by the Westinghouse Electric & Manufacturing Company. The new unit is designed to furnish sufficient illumination over an uneven field, at the same time keeping the source of light low and eliminating objectionable glare in the eyes of the aviator. It consists essentially of a steel drum 25 in. in diameter and 19 in. deep, mounted on a 2½-in. pipe standard. Mounted within the drum are a lamp socket with vertical, lateral and in-and-out focusing adjustments, a 23-in. parabolic metal reflector of such focal length that all reflected rays come approximately within a 3-deg. divergence, and a system of louvers to absorb all those rays of direct light the upward tilt of which exceeds 1½ deg. A spread lens mounted in front of the shell gives a horizontal spread of 45 deg. to the beam.

The unit is so mounted on the pipe standard that it may be rotated horizontally or tilted vertically 2 deg. above and 6 deg. below the horizontal. It is dust-proof and rain-proof and weighs about 160 lb. exclusive of the pipe standard. When equipped with a 1,500-watt proection lamp and spread lens the unit gives a maximum intensity of 250,000 cp. The projector may be very accurately focused by the use of a daylight lamp setter developed for the purpose.

Ball-Bearing Motors

A line of ball-bearing squirrel-cage polyphase induction motors from ¼ hp. to 50 hp., known as the type IM, has been developed by the B. F. Sturtevant Company, Hyde Park, Boston. The type IM motors are designed for constant speed and for voltages of 220, 440 and 550, also for 110 volts up to 15 hp., two or three phase, for standard frequencies of 25 and 60 cycles. These motors can also be furnished for 30, 40 or 50 cycle operation. The rotors are of the welded-end-ring type and are ground after the core is assembled so as to maintain a small and uniform air gap. The type of construction of this line of motors is such that the end shields can be removed without removing the ball bearings from the shafts as the caps are on the inside. As shown in the accompanying assembly drawing of the motor the bearings are sealed tight through a system of felt washers.



ASSEMBLY DRAWING OF THE BALL-BEARING, SQUIRREL-CAGE TYPE IM INDUCTION MOTOR

Cam-Type Limit Switch

A rotating cam-type limit switch for use with magnetic controllers for the automatic control of machines having such fixed sequence of operation as slowing down, stopping and reversing has been placed on the market by the Electric Controller & Manufacturing Company, Cleveland. This cam-type limit switch is totally inclosed, is equipped with tapered roller bearings and is designed to carry up to six sets of contacts. The cams, which operate the opening and closing of the contacts, are each adjusted independently of the others and can be fixed at any one of an infinite number of positions.

Melting Pot

An electrically heated melting pot for melting solder, lead, babbitt, tin, etc., and having a capacity of 100 lb., has been placed on the market by the Harold E. Trent Company, 259 N. Lawrence Street, Philadelphia. The company states that this larger unit, which can also be used for melting salts requiring a temperature less than 1,000 deg. F., has all the advantages of quick heating, compactness of design and reliability of the smaller sizes. A cast-iron terminal box is provided with an outlet in the bottom which can be arranged for connection of flexible or rigid metal conduit. The terminals are placed horizontally from the side walls of the casting, which facilitates connection and inspection. When required, this melting pot can be supplied with semi-rigid eye bolts secured on the rim of the casting so that it will be portable and can be used when pouring the metal directly from the pot into the mold. The crucible is of a special grade of cast iron which has been properly proportioned to stand the strain incident to heating and cooling a considerable mass of metal. The casing is sheet steel with welded seams reinforced with steel bands. With this larger size of melting pot, the company recommends the use of a temperature control.

Tachometer.—The "Standco" pocket-size tachometer, with a range in speed from 60 to 8,000 r.p.m., has been placed on the market by Herman H. Sticht & Company, 15 Park Row, New York City. All the necessary accessories are self-contained or attached to the reverse side, thus eliminating a carrying case. The instrument is equipped with a spirit level to facilitate holding it in a horizontal position, and it also has a pointer-locking device which permits of locking the pointer when it comes to scale. The tachometer also contains an automatic protective device for the measuring element which protects the rotary element if the instrument is accidentally used for high-speed measurement while the gear shift is set for low-speed measurement.

New Trade Literature

BRAKES.—Bulletin No. 102-A distributed by the Clark Controller Company, Cleveland, describes the Clark "Three C" brakes for mechanical operation. A line drawing showing the Clark "Three C" brake arranged for mechanical operation and approximate dimensions are included.

RESISTORS FOR RADIO.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued circular No. 507, covering the "Vitrohm" resistors for radio circuits. This bulletin contains a short sketch of the manufacturing process of the "Vitrohm" resistor and also contains a list of the various types of "Vitrohm" resistor units.

AUTOMATIC WELDING HEAD AND CONTROL. — The General Electric Company, Schenectady, N. Y., is distributing bulletin GEA-556, describing the "G-E" automatic welding head and control (automatic electrode feeding device, magnetic-clutch type). A wiring diagram of the "G-E" automatic welding head and control is included.

POLE-LINE HARDWARE.—Hubbard & Company, Pittsburgh, has issued a catalog covering the Hubbard pole-line hardware for telephone construction, made to meet the specifications of the American Telephone & Telegraph Company.

ELECTRICAL HOUSEHOLD APPLIANCES.—A booklet issued by the Fitzgerald Manufacturing Company, Torrington, Conn., describes and illustrates the "Star-Rite" electrical household devices, including toasters, heating pads, fans, heaters, health appliances, etc.

NICKEL-STEEL DATA. — A series of bulletins on nickel-steel data and applications, with a loose-leaf binder, is being distributed by the International Nickel Company, 67 Wall Street, New York City. Nine bulletins of this series have been issued to date.

BLOWER.—Bulletin No. 2,004 issued by the American Blower Company, Detroit, describes and illustrates the type "SE" steel-plate blower, which is particularly adapted to forced-draft installations where absolute dependability is essential and where a blower requiring little or no attention is desirable. Dimension and capacity tables of the type "SE" doublet-inlet blower are included.

TRICKLE-CHARGING SYSTEM.—"The Balkite Trickle Charging System" is the title of a booklet issued by the Fansteel Products Company, Inc., North Chicago, Ill., in which it describes the "Balkite" trickle-charging system and its application to various electrical devices. Attention is also called to various other types of charging equipment manufactured by the company.

SUPERVISORY EQUIPMENT. — The General Electric Company, Schenectady, N. Y., is distributing leaflet GEA-545, superseding 67,741, describing the selector supervisory equipment for control and indication of remote power apparatus.

ELECTRICAL PROTECTING MATERIALS AND CONDUIT FITTINGS.—The Chicago Fuse Manufacturing Company, Laflin and Fifteenth Streets, Chicago, has issued catalog No. 31 covering its electrical protecting materials and conduit fittings, including union renewable fuses and renewal links, union indicating non-renewable fuses, cut-out bases, cut-out fittings, union outlet boxes, gem switch boxes, including sectional, bracket and "Locktite" types, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Hamburg, Germany (No. 23,396), for electric household equipment.

Purchase is desired in Milan, Italy (No. 23,378), of electric motors and batteries and electric trucks and parts.

Purchase is desired in Leipzig, Germany (No. 23,377), of radio sets and parts.

Purchase is desired in Patras, Greece (No. 23,352), of ammonia compression refrigeration machinery.

Purchase is desired in Zurich, Germany (No. 23,425), of an electrically operated gasoline vacuum system.

An agency is desired in Paris, France (No. 23,433), for electric heating and cooking appliances, radio sets and parts and electric refrigerators; also for motor-driven household arpliances, electric heating and cooking appliances and electric refrigerators (No. 23,455).

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

WEST ENFIELD, ME.—Bids have been called by the Bangor (Me.) Hydro-Electric Company for a power development in West Enfield.

BOSTON, MASS.—Plans are being prepared by the Edison Electric Illuminating Company for a substation at 31 Hawkins Street, to cost about $40,000. Bigelow & Wadsworth, 120 Tremont Street, are engineers.

HAVERHILL, MASS.—Plans are being prepared by the Haverhill Electric Company for the construction of a building on Merrimack Street, to cost about $40,000. C. H. Tenney & Company, 200 Devonshire Street, Boston, are engineers.

EAST HAMPTON, CONN.—Plans are under consideration by the Central Connecticut Power & Light Company for extensions to its hydro-electric plant at Leesville, involving an expenditure of about $1,000,000. The work includes the construction of a dam on the Salmon River, addition to the power house, etc. When the work is completed the company plans to furnish current to the Essex (Conn.) Power & Light Company.

WATERBURY, CONN.—The Connecticut Light & Power Company has signed a contract to furnish electricity to the New York, New Haven & Hartford Railroad Company, which will be supplied from its Devon hydro-electric plant. Tentative plans are now under way by the Connecticut company for building a new power unit at Devon, to cost about $300,000.

Middle Atlantic States

AMSTERDAM, N. Y.—Further extensions to the ornamental lighting system will be provided for under the new street-lighting contract now being prepared with the Adirondack Power & Light Corporation, Schenectady.

BROOKLYN, N. Y.—Bids will be received by the Department of Mental Hygiene, Capitol, Albany, until Jan. 19, for electric elevators for Creedmoor Division, of the Brooklyn State Hospital, Queens.

BROOKLYN, N. Y.—Plans have been filed by the Brooklyn Edison Company for the erection of an equipment, repair and garage building, at 300-38 Fourth Avenue, to cost about $1,000,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 11, for furnishing electric kitchen, and cake and vegetable peeling machines, boiler tubes, high frequency apparatus, etc., to the Navy Supply Depot, Brooklyn.

GREECE, N. Y.—A contract has been awarded by the Town Board of Greece for the installation of a street-lighting system in Brookside, a new development in the town of Greece, to the Rochester (N. Y.) Gas & Electric Company. This installation is to be part of a large system for lighting the rural highways of the town.

HEMPSTEAD, N. Y. — The Village Trustees have accepted the proposal of the Long Island Lighting Company, New York, for the installation of an ornamental lighting system. The plans provide for 177 lamps, maintained by underground wires.

KINGS PARK, N. Y.—Bids will be received by the Department of Mental Hygiene, Capitol, Albany, until Jan. 19, for one electric elevator for Kings Park State Hospital, Kings Park.

ROCHESTER, N. Y.—Plans have been prepared by the Rochester Gas & Electric Corporation for the construction of a pole-treating and distributing plant, to cost about $45,000.

UTICA, N. Y.—The installation of an ornamental lighting system on Genesee Street, from Beggs Square to Deerfield Corners, has been authorized by the City Council.

CHESTER, PA.—A permit has been granted the Aberfoyle Manufacturing Company to build a power house at its local textile mill. The equipment will include a turbo-generator, boilers, etc.

COATESVILLE, PA. — The Bethlehem Steel Company has contracted with the Chester Valley Electric Company to furnish power to operate its Coatesville shop. The contract calls for 12,000 hp. for a period of five years. Work has been started to connect the Bethlehem plant with the station of the Chester Valley Electric Company.

SCOTT HAVEN, PA.—Permission has been granted the West Penn Power Company, Pittsburgh, to erect a transmission line across the Youghiogheny River, near here.

VIENNA, MD.—The directors of the National Public Service Corporation, 165 Broadway, New York City have authorized a new central station to be erected on the Nanticoke River at Vienna, to cost about $1,500,000. About $500,000 has been appropriated for transmission lines in connection with the new station. Plans are being prepared by the engineers of the General Engineering & Management Corporation, 165 Broadway, New York, for the new station which will be built in units, the initial installation calling for two 6,000-kw. Westinghouse turbines and three boilers, operating at 350 lb. The furnaces will be provided with underfeed, multiple retort stokers. To connect this plant to the general system it will be necessary to carry a 1,600 ft. span across Nanticoke River on 200 ft. towers.

SCRAFFORD, W. VA. — The West Virginia Utilities Company, Morgantown, has secured permission to erect a transmission line across the Monongahela River at Scrafford. Steel towers are proposed.

WASHINGTON, D. C.—Bids will be received by the United States Coast Guard Headquarters, Washington, until Jan. 25, for three turbo-electric ship propulsion sets, and other equipment for coast guard cutters Nos. 45, 46 and 47.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Jan. 19, for electric sirens, electric horns, etc. (Panama Circular 1777).

North Central States

DETROIT, Mich.—Plans are under way by the Michigan Bell Telephone Company, for installing 80,000 ft. of main and feeder cables for territory adjacent to Puritan and Muirland Avenues, to cost about $100,000.

LAKEVIEW, MICH.—The Western Hydro-Electric Company, which has acquired the local electric plant, is planning to erect a transmission line to Coral and Trufant, which will furnish electricity to light several summer resorts in that vicinity.

HAMILTON, OHIO—The City Council has engaged Froelich & Emory, Toledo, to prepare plans for a new power house for the municipal electric system, to cost about $500,000.

ROSWELL, OHIO—The Ohio Power Company, Canton, has been granted a franchise to furnish electricity here and for street-lighting. The company proposes to erect a transmission line from a substation to be erected below Midvale. The cost of the substation will be, it is estimated, $25,000.

LOUISVILLE, KY.—The Kentucky Utilities Company has started work on the erection of 32 miles of 33,000-volt transmission line from Stanford to Somerset, designed for future conversion to 66,000 volts. It will be tapped to supply service at Eubank and Waynesburg. A 33,000-volt substation will be built at Somerset to utilize power from the Dix River plant, to cost about $138,000. The company plans to erect a 33,000-volt transmission line from Burgin to Harrodsburg, 4 miles long, at a cost of $40,000. The transformer station at Lancaster will be increased from 45 to 100 kva. capacity, and an additional transformer of 100 kva. will be installed at the substation at Kuttawa.

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, Chicago, until Jan. 18, for 2900 telephone transmitter heads (Circular 16).

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, Chicago, until Jan. 12, for ten retardation

coils and ten transformers, (Circular 14); also, for 24,000 porcelain knobs, 3600 telephone brackets, etc. (Circular 15).

CHICAGO, ILL.—The Commonwealth Edison Company plans extensions and improvements in its transformer repair and machine shop at Roscoe and California Avenues, to cost about $50,000. Holabird & Roche, 104 South Michigan Avenue, are architects.

CHICAGO, ILL.—Bids will be received by Harry E. Wallace, of the Sanitary District of Chicago, 910 South Michigan Avenue, until Jan. 20, for the West Side sewage treatment works, Division C, consisting of pumping station substructure, etc., and conduit work and also furnishing and erecting electrical equipment.

ANTIGO, WIS.—Bids are being received by the Kraft Cheese Company for the construction of a new power house, to provide space for three 150-hp. boilers.

CHIPPEWA FALLS, WIS.—Plans are under way by the Northern States Power Company, Eau Claire, for a hydro-electric development at Chippewa Falls on the Chippewa River. The plant will be built under the supervision of the Byllesby Engineering & Management Corporation, 231 South La Salle Street, Chicago. It will have a capacity of 24,000 hp., in six units of 4,000 hp. each, and will cost about $2,600,000.

MADISON, WIS.—The Board of Trustees of the University of Wisconsin is considering the construction of an electrical laboratory, to cost about $395,000. J. D. Phillips is business manager.

MARINETTE, WIS.—Plans have been approved by the City Council for the installation of an ornamental lighting system, consisting of 120 lamp standards mounted with one lamp. The cost is estimated at about $20,000.

HAMMOND, MINN.—Plans are being prepared by W. B. Drury to build a hydro-electric plant near Jarrett to serve Millville, Hammond and Zumbro Falls.

ST. PAUL, MINN.—The City Council has authorized the installation of ornamental lamps on portions of Carroll, Desnoyer and Glenham Avenues. G. M. Shepard is city engineer.

DAVENPORT, IOWA — The Kohrs Packing Company has awarded a general contract to the Priester Construction Company, Kahl Building for the construction of a power plant at Thirteenth Avenue and West Second Street, to cost about $50,000.

DES MOINES, IOWA—The City Council has authorized the installation of an ornamental lighting system on Seventh Street, and on East Grand Street.

EAGLE GROVE, IOWA—The City Council has authorized plans for the construction of a municipal electric power plant. H. L. Cory & Company, Aberdeen, S. D., are engineers.

MACON, MO.—Surveys are being made in connection with the proposed improvements to the municipal electric light plant and waterworks. The Burns & McDonald Engineering Company, 402 Interstate Building, Kansas City, are engineers.

MOBERLY, MO.—Permission has been granted the Missouri Power & Light Company, Mexico, to erect a 33,000-volt transmission line (wooden poles) between Moberly and State Highway No. 8.

PARK RIVER, N. D.—The installation of an ornamental lighting system on Main Street is under consideration.

ABERDEEN, S. D.—Work has been started by the Northwestern Public Service Company on the erection of three transmission lines: One from Mellette to Redfield, 50 miles long; extension of 33,000-volt line from Redfield to Wolsey, and from Redfield to Rockham and Orient. A new distribution system will be installed at Rockham.

BELLE FOURCHE, S. D.—Plans for the proposed local sugar mill to be built by the Utah-Idaho Sugar Company, Salt Lake City, Utah, at a cost of about $1,500,000, include a power plant.

DAVID CITY, NEB.—The construction of a power station in David City, to cost about $110,000, is under consideration by the Western States Public Utilities Company, Lincoln.

Southern States

MURPHY, N. C.—The Hiawasee Power Company has applied for permission to build a hydroelectric plant on the Hiawasee River, Polk County, Tennessee, to cost about $200,000, with transmission system.

KINGSTREE, S. C.—Work will soon begin by the Broad River Power Company on the erection of a 66,000-volt transmission line from Manning to Sumter, to connect with the hydro-electric transmission line now under construction by the Carolina Power & Light Company from Camden to Sumter.

WALTERBORO, S. C.—The Edisto Public Service Company, Denmark, which has acquired the municipal electric plant, is planning extensions in its transmission lines in this section.

BUTLER, GA.—The electric distribution system of the Butler Light & Power Company has been purchased by the South Georgia Power Company, Albany, which will extend its transmission lines to Butler to furnish electricity for the local system.

HELENA, GA.—The local electric distribution system has been purchased by the Georgia Southern Power Company, Dublin, which is making improvements to same.

NEW SMYRNA, FLA.—The City Council is considering the installation of an ornamental lighting system in the business district.

ESTILL SPRINGS, TENN.—Plans are under way by the Southern Cities Utilities Company, Chattanooga, for the construction of a local steam-driven electric plant from 15,000 to 20,000 hp. capacity. Extensions will be made in transmission lines.

GREENVILLE, ALA.—The City Council has preliminary surveys under way for a proposed municipal electric power plant to cost about $20,000.

GULFPORT, MISS.—The City Council is considering the installation of a municipal electric plant. Hobart D. Shaw is city engineer.

OKLAHOMA CITY, OKLA. — Preliminary plans are being prepared by the Oklahoma Gas & Electric Company for the erection of a 33,000-volt transmission line from Garber to the Kansas state line, Arkansas City, 75 miles long. The cost is estimated at $75,000.

PONCA CITY, OKLA. — At a special election held recently bonds to the amount of $300,000 were approved by the voters, the proceeds to be used for extensions and improvements in the municipal electric light and power plant.

AUSTIN, TEX.—Bids will be received by the Board of Trustees, University of Texas, until Jan. 18, for a power plant for the institution. The Herbert M. Greene Company, Santa Fe Building, Dallas, is architect.

CHILDRESS, TEX. — Plans are being prepared by the Central Power & Light Company, San Antonio, to erect a transmission line from Childress to Clarendon, a distance of 60 miles. The cost is estimated at $100,000.

DALLAS, TEX.—The Board of Trustees of the Southern Methodist University has authorized the construction of a power plant at the institution to cost about $50,000. Coburn, Smith & Evans, Republic Building, are architects.

MIDLAND, TEX.—Plans are being prepared by the Morgan Utilities, Inc., Little Rock, Ark., for the construction of a local steam-operated power plant, to cost about $150,000.

PLAINVIEW, TEX.—Plans are under way by the Texas Utilities Company for further expansion of its electric transmission system in northwest Texas during the coming year. Work will start immediately on the erection of a steel tower high-tension line from Floydada to Crosbyton. The company will also extend its transmission system to a number of towns in the South Plains.

QUANAH, TEX.—Plans are under consideration by the Southwestern Light & Power Company, Lawton, Okla., for the construction of a large electric power plant at Lake Pauline, near Quanah. The company also contemplates erecting transmission lines to connect up its plants in Oklahoma and north Texas with the proposed plant.

Pacific and Mountain States

ABERDEEN, WASH.—The Grays Harbor Railway & Light Company is planning to install an auxiliary fuel oil system, to cost about $15,000, to supplement the fuel burners now in use.

BELLINGHAM, WASH. — The Puget Sound Power & Light Company, Seattle, through its Bellingham branch is seeking a franchise over approximately 145 roads in Whatcom County.

EVERETT, WASH. — Plans are being prepared for the installation of a new street-lighting system in the down town district.

MONTESANO, WASH. — The Puget Sound Light & Power Company, Seattle, has been granted permission to extend its transmission lines in this section.

ALHAMBRA, CAL.—The installation of an ornamental lighting system on portions of Second, Third, Fourth and Fifth Streets, to cost about $25,000, is under consideration by the City Council.

COMPTON, CAL.—Plans are under way by the City Council for the installation of an ornamental lighting system on Sloan and Poinsettia Streets, consisting of about 400 units. Concrete standards will be used. Edward M. Lynch is city engineer.

GLENDALE, CAL. — The City Council has authorized the purchase of property at Howard, Wildon and Geneva Streets, as a site for a proposed substation for the municipal electric system.

INGLEWOOD, CAL.—Arrangements are being made by the City Planning Commission for the installation of ornamental lamps, using combination light and traction poles, on Market Street.

LOS ANGELES, CAL.—The Bureau of Power and Light has appropriated $500,000, for initial work on the proposed steam-operated electric power plant in the harbor district.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Masselin, Sierra Bonita and Curson Avenues, on portions of Hauser Boulevard and Packard Streets using concrete standards; and also on portions of the Pico and Roberston Boulevards, using steel standards.

SAN FRANCISCO, CAL.—The installation of an ornamental lighting system on OFarrell Street, between Mason and Van Ness Avenue and on Powell Street, between Sutter and California Streets to cost about $25,000, is under consideration by the City Council. M. M. O'Shaughnessy is city engineer.

SAN FRANCISCO, CAL.—Bids are being asked by the California State Board of Harbor Commissioners, Ferry Building, for ferry terminal, creosoted piles, aprons of structural steels truss construction with electrically-operated machinery at the foot of Hyde Street, to cost about $100,000. F. G. White, Ferry Building, is engineer. The commission will furnish cement and poles.

SAN JOSE, CAL.—Plans have been filed by the Pacific Gas & Electric Company, San Francisco, for the erection of four service, repair and equipment buildings at Linden Avenue and Stockton Street, to cost about $75,000.

YREKA, CAL.—The City Council has negotiations under way for the purchase of a privately-owned power plant, to be owned and operated by the municipality. If acquired extensions and improvements will be made to the system.

MURRAY, UTAH—Bids will be received by the City Council until Jan. 27, for a Diesel engine-driven generating unit for the municipal electric plant. T. F. McDonald is city engineer.

SALT LAKE CITY, UTAH—The Utah Power & Light Company has applied for certificates of convenience and necessity to serve electricity to the towns of Castle Dale and Ferron, where the company has been granted franchises by the Town Boards.

CHUGWATER, WYO.—The City Council is considering extensions and improvements in the lighting system on a number of streets.

BROADMOOR, COL. — The Broadmoor Hotel Water & Power Company has applied to the Public Utilities Commission for permission to serve the town of Broadmoor with electricity and water. Post office address is Colorado Springs.

Canada

WINNIPEG, MAN. — Plans are under consideration by the Manitoba Power Company for large extensions to its substation equipment during 1927.

ARNPRIOR, ONT. — Plans are under consideration by the Town Council for the construction of a dam and power house on the Madawaska River, to develop 3,000 hp. The cost of the project is estimated at about $454,000.

MIMICO, ONT.—The Town Council has passed a by-law authorizing an appropriation of $15,000 for extension to the Hydro-Electric system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 30, 1926)

1,609,024. ARRANGEMENT FOR REDUCING THE STARTING VOLTAGE OF DISCHARGE TUBES WITH A GASEOUS FILLING; D. Lely, Jr., and H. Filippo, Eindhoven, Netherlands. App. filed Jan. 29, 1923.

1,609,039. LIGHT-OPERATED SWITCH; L. Ortego, Alexandria, La. App. filed May 12, 1925. Means for utilizing the energy of light to open or close the contacts of an electrical circuit.

1,609,042. ELECTRIC CIGAR LIGHTER; M. Trapet, Los Angeles, Cal. App. filed March 18, 1925.

1,609,124. INSULATOR SUPPORT; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed March 11, 1920. An insulator support member which may be pressed from sheet metal such as sheet steel.

1,609,132. ELECTRIC HEATER; J. E Sederholm, St. Paul, Minn. App. filed Aug. 4, 1924. An apparatus adapted to heat and expand steel tires to be shrunk onto wheels of a locomotive.

1,609,146. SELECTOR; J. H. Wheelock, Fitzwilliam, N. H. App. filed June 13, 1917. Selective-control mechanism of general application to mechanical as well as to electrical systems, although in the specific embodiment it is applied to electric call or annunciator systems.

1,609,223. SNAP SWITCH; A. H. Trumbull, Stratford, Conn. App. filed Aug. 11, 1922

1,609,230. SWIVEL ATTACHMENT PLUG; C. E. Warner, Berwyn, Ill. App. filed Nov. 1, 1920.

1,609,243. ELECTROTHERAPEUTIC ELECTRODE; J. H. Eastman, Detroit, Mich. App. filed Dec. 19, 1924.

(Issued Dec. 7, 1926)

1,609,280. PLATE-SUPPORTING MEANS; B. H. Caldwell, Niagara Falls, N. Y. App. filed Sept. 24, 1917. For large storage batteries, as, for instance, those used in marine service.

1,609,310. MOTOR; J. A. Rodgers, St. Louis, Mo. App. filed March 23, 1925. Arranged to operate at different speeds with provision for starting the motor to develop any one of the speeds, the control of the motor being at a common switch point. A motor equipped with field windings constituting main circuits of a different number of poles and complementary starting or phase windings of a number of poles corresponding with the main windings respectively, said phase windings being in series and adapted to be placed in circuit selectively with the main windings, whereby the circuits may be controlled to start the motor with any main winding in circuit.

1,609,317. COOKING APPARATUS; C. A. Smith, Washington, D. C. App. filed Jan. 31, 1925.

1,609,324. ELECTRIC RELAY; S. S. Stolp, Mansfield, Ohio. App. filed Jan. 18, 1923. Time delay .

1,609,357. ELECTROLYTIC PLATING MACHINE; J. Hulmer, Chicago, Ill. App. filed Nov. 19, 1925.

1,609,358. REGULATING APPARATUS; G. E. Hulse, New Haven, Conn. App. filed Jan. 19, 1925. Employed in a circuit containing a storage battery and adapted to make most efficient utilization of the charge of the storage battery.

1,609,374. ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed July 14, 1920. Swivel type.

1,609,411. ELECTRICAL INSTALLATION FOR RAILWAY AND LIKE VEHICLES; A. E. Kennard, Upper Norwood, London, England. App. filed Dec. 1, 1925. Dynamo-lighting unit which cannot exceed a given output owing to the self-regulating character imparted to it in its electrical design.

1,609,412. ELECTRIC DRIER; P. Kolisch, Brooklyn, N. Y. App. filed Feb. 25, 1926. In which in addition to means for generating hot and cold blasts of air, a source of heat and light in the form of an electric lamp is provided.

1,609,433. SYSTEM OF CONTROL; E. W. Seeger, South Milwaukee, Wis. App. filed March 22, 1926. Testing system for motor controllers.

1,609,531. ELECTRIC MOTOR OR GENERATOR; L. M. Woolson, Detroit, Mich. App. filed April 18, 1922. A dynamo-electric machine comprising a substantially cylindrical shell part, an integral end part having a contracted portion forming a cylindrical supporting neck, and a detachable end part for the other end of the shell.

1,609,553. CIGAR LIGHTER; E. M. King, Seattle, Wash. App. filed Aug. 4, 1924.

1,609,646. APPARATUS FOR CONTROLLING CIRCUITS; S. F. Focht, Cleveland, Ohio. App. filed Aug. 28, 1924. Adapted to throw on and off one or more lights and also actuate a locking mechanism, if desired.

1,609,665. DRY GALVANIC CELL; A. Rugler, Berlin-Erkner, Germany. App. filed Sept. 26, 1925.

1,609,687. ELECTRIC METER; C. E. Brandt, E. A. Fouilleret and R. M. Fichter, Paris, France. App. filed Dec. 14, 1923. Of the induction type; the combination of an elongated stationary pivot bearing, a rotating part pivoting on the bearing and comprising a light hollow armature provided with equidistant stamped impressions and a vertical shaft secured to the top part of the armature, the center of gravity of the rotating part being below the pivoting point, and an upper bearing secured to the casing of the meter and adapted to guide the vertical shaft.

1,609,692. PRIMARY AND SECONDARY ELECTRIC CELL; A. Cellino, Rome, Italy. App. filed Nov. 6, 1924.

1,609,744. MULTIPLE PIEZO-ELECTRIC CRYSTAL HOLDER; A. M. Trogner, Takoma Park, Md. App. filed June 4, 1926. A mounting for a plurality of piezo-electric crystal devices used in the control of high-frequency circuits at different frequencies.

1,609,745. MAGNETIC CORE; C. E. Vawter, Philadelphia, Pa. App. filed Jan. 4, 1924. For high-frequency work.

1,609,749. ELECTRIC WELDING; J. W. White, Detroit, Mich. App. filed Dec. 1, 1920. Welding of joints in which a considerable area of surface is to be connected.

1,609,761. SOCKET FOR ELECTRIC LAMPS; L. Mayer, Boston, Mass. App. filed Oct. 17, 1925. Sockets for use in spot lights and domes for automobiles.

1,609,767. GIGARETTE IGNITER; L. Pengilly, San Francisco, Cal. App. filed March 1, 1926.

1,609,770. INVERSE TIME-LIMIT RELAY; W. H. Petersen, Ludvika, Sweden. App. filed May 26, 1921. Induction type, which is free from creeping.

1,609,771. PROCESS AND APPARATUS FOR ELECTROLYTIC REFINING; F. F. Poland, Baltimore, Md. App. filed Aug. 11, 1925. Spacers for electrodes.

1,609,799. BATTERY SHIELD; C. C. Douglas, Buffalo, N. Y. App. filed Oct. 9, 1923.

1,609,800. CIRCUIT CONNECTOR; H. A. Douglas, Bronson, Mich. App. filed Sept. 3, 1925. Employing shells that carry contacts within their interiors and contact carriers provided with contacts complemental to the aforesaid contacts and adjustably assembled with the shells in order to open and close the circuit.

1,609,859. ELECTRIC BLOWTORCH; H. A. Bond, Sacramento, Cal. App. filed Feb. 24, 1926. In which an electric arc in connection with an air blast is used as the heating and cutting medium.

1,609,870. INDIRECT LIGHTING FIXTURE; C. E. Ferree, Bryn Mawr, Pa. App. filed Dec. 9, 1924.

1,609,920. PORTABLE ELECTRIC LUMBER-AND-TIMBER GRADE-MARKING DEVICE; H. W. Whited, Nacogdoches, Tex. App. filed July 6, 1925.

1,609,925. INCLOSED ELECTRIC SWITCHBOARD; M. B. Wood, Somerville, Mass. App. filed Dec. 11, 1924. Of the removable-truck type. An inclosed switchboard of the removable type with a shutter for isolating the stationary terminals of the disconnecting switch and other fixed live conductors in the truck compartment and with operating means for the shutter so arranged and interconnected with the truck that the operative is compelled manually to lower the shutter into isolating position before he can remove the truck entirely from its compartment and also is compelled to raise the shutter to an inoperative position before he can move the truck entirely into its compartment and connect the switch with its line.

1,609,976. TRANSMISSION OF HIGH-TENSION CURRENTS; G. Viel, St. Etienne, France. App. filed Oct. 31, 1922. In the transmission of high-tension currents the combination of a line wire, chain insulators suspending such line wire, a balance wire connecting together corresponding insulators of the several chains and impedances between the line wire and the balance wire.

1,610,012. STRAIN-INSULATOR; CLEVIS AND WIRE CLAMP; S. N. Jordan, Burlington, Iowa. App. filed Nov. 16, 1925.

1,610,033. WIRE TERMINAL CLIP FOR TOY TRACKS; H. S. Becker, River Forest, Ill. App. filed April 25, 1925.

1,610,038. DEMAND INDICATOR AND CONTROLLER; W. T. Chapman, Niskayuna, N. Y. App. filed Dec. 18, 1924.

1,610,041. ANNEALING APPARATUS; F. T. Cope, Salem, Ohio. App. filed Feb. 23, 1925. For annealing narrow strips or bands of metal, wire and the like.

1,610,044. ELECTRICAL CONNECTOR; P. R. Fortin, Schenectady, N. Y. App. filed Oct. 19, 1921. Of the type which may be readily attached and detached from a conductor.

1,610,050. ELECTRIC HEATER; W. W. Hicks, San Francisco, Cal. App. filed May 3, 1926. Used as auxiliary equipment to a central heating installation.

1,610,052. ELECTRIC CONNECTOR; C. E. Holmes, Lynn, Mass. App. filed Feb. 21, 1923. As used in electrical instruments for connecting the internal instrument lead to the outgoing circuit.

1,610,059. VAPOR ELECTRIC DEVICE; C. Kramer, Pankow, Germany. App. filed June 20, 1923. Mercury-arc rectifier of large power with means for preventing deleterious reverse arcing and similar disturbances.

1,610,061. PROCESS FOR PRODUCING TUNGSTEN AND MOLYBDENUM CARBIDE IN LUMPS OF VARIOUS SIZES; J. Lohmann. Berlin-Johannisthal, Germany. App. filed Aug. 26, 1921.

1,610,062. ELECTRIC LAMP; J. C. Lokker, Hendrik Filippo and P. Schoonenberg, Eindhoven, Netherlands. App. filed Feb. 14, 1923. Having light-diffusing globes of the white color type.

1,610,063. CONTAINING CELL FOR ELECTRIC BATTERIES; L. Lyndon, New York, N. Y. App. filed Dec. 23, 1919. For the lead-oxide type.

1,610,064. ELECTROMAGNETIC DEVICE; W. L. Merrill, Schenectady, N. Y. App. filed Dec. 13, 1921. Electromagnetic switch with means for preventing the vibration of the movable magnetic member of the electromagnetic device and the vibration of the switch member connected thereto in case the electromagnetic device is an electric switch.

1,610,077. ELECTRIC LAMP; P. K. Devers, Jr., Lynn, Mass. App. filed June 1, 1923. Arc lamp of high efficiency which will emit substantially white light.

1,610,080. MOTOR CONTROL; J. Eaton, Schenectady, N. Y. App. filed Nov. 20, 1922. Limit control as in the control of an electric motor for operating a valve.

1,610,085. INSULATOR; W. T. Goddard, Hamilton, Ontario, Canada. App. filed Nov. 29, 1922. Wherein a number of insulating units are connected in nested relation to form an insulator.

1,610,116. ELECTRIC HEATER; R. E. Woods and J. D. Watkins, Porterville, Cal. App. filed Oct. 20, 1925.

1,610,128. SOCKET ON CONNECTOR; C. E. Godley, Detroit, Mich. App. filed March 27 1926. In which the socket portion is at least partially housed by a tubular supporting holder, as, for example, by a collar secured to the body of an automobile lamp.

1,610,135. POCKET ELECTRIC LIGHTER; G. D. Kelsey, Paterson, N. J. App. filed Jan. 26, 1926.

1,610,179. FLOW METER AND THE LIKE; L. W. Thompson, Schenectady, N. Y. App. filed Nov. 20, 1923.

1,610,189. THERMALLY OPERATED SWITCH; G. H. Whittingham, Baltimore, Md. App. filed Dec. 19, 1924.

1,610,203. INSULATING COMPOSITION, PROCESS AND ARTICLE; B. S. Covell, Meriden, Conn. App. filed Aug. 15, 1922. A cold moldable composition comprising cement 35 per cent to 61 per cent, slate flour 41 per cent to 15 per cent, and waterglass solution approximately 18 per cent.

1,610,205. BATTERY-CHARGING APPARATUS; E. C. Fritts, Rochester, N. Y. App. filed Nov. 5, 1923. Connection element having a polarity indicator.

1,610,213. AUTOMATIC SWITCH; E. J. De Ville, Dayton, Ohio. App. filed April 7, 1921. Of the quick-acting type.

(Issued Dec. 14, 1926)

16,503 (reissue). FUSE; J. W. Hooley, Larchmont, N. Y. App. filed Oct. 30, 1925. Will indicate on its face its current capacity in clear terms.

1,610,227. MEASURING INSTRUMENT; C. T. Allcutt, Pittsburgh, Pa. App. filed July 7, 1920. Means for and methods of measuring the phase-sequence components of an electrical quantity. A device for indicating the positive and negative phase-sequence component of the voltage on a polyphase electric circuit.

1,610,228. ELECTRICAL CONTROLLER; E. H. Allfree and A. R. Williams, Ironton, Ohio. App. filed April 28, 1925. Flame-proof; as used in mine locomotives.